

XXIV. "Preliminary Report of the Biological Results of a Cruise in H.M.S. 'Valorous' to Davis Strait in 1875." By J. GWYN JEFFREYS, LL.D., F.R.S. Received June 12, 1876.

[PLATES 2-4.]

On this occasion I propose to adopt the same course that was taken in presenting to the Royal Society the Preliminary Report of the scientific exploration of the deep sea in H.M. Surveying-vessel 'Porcupine' in the years 1869 and 1870, in both of which expeditions I took a part.

NARRATIVE.

1. The Government having, at the instance of the Society and other scientific bodies, determined to equip and send out last year two ships (the 'Alert' and 'Discovery') on a North-Polar Expedition, and with these vessels the 'Valorous' frigate as a store-ship to accompany them as far as Disco in Davis Strait, it was considered desirable to make the last-named vessel available for sounding and dredging on her return voyage. Accordingly the following correspondence with the Admiralty took place, and will serve to explain the circumstances under which the scientific results now about to be noticed were obtained :—

"Council Minutes, April 15.

"Read the following letter from Dr. Carpenter :—

"University of London, Burlington Gardens, W.,
April 14, 1875.

"DEAR MR. PRESIDENT,—Since I wrote to you on the subject of the Arctic Expedition, the Admiralty has decided upon sending as a store-ship, not the merchant-vessel then contemplated, but a man-of-war of considerable tonnage. Although there will be no opportunity on the voyage to Disco for any scientific observation that would delay the progress of the Expedition, yet such opportunity will be available both while the ship remains at Disco and on the *return* voyage, which will be made at a time of the year most likely to be favourable. And I have reason to believe that the Admiralty authorities are quite willing that advantage should be taken of this opportunity, to such an extent as circumstances may permit, if the Council of the Royal Society should be of opinion that valuable results are likely to be obtained by the utilization of it.

"I have already pointed out to you that a Temperature-Section across the North Atlantic to Cape Farewell and Temperature-Sections, transverse and longitudinal, in Baffin's Bay are just what are needed to complete the survey of the thermal condition of the great oceanic areas that is being so admirably carried out by the 'Challenger.'—The same remark applies also to the zoological inquiry, the animal life of great depths in the North Atlantic and Arctic Seas being still very imperfectly known.

So strongly does Mr. Gwyn Jeffreys feel interested in carrying out this inquiry, that he has volunteered his services for the purpose; and I cannot but believe that the Council will cordially recommend the acceptance of his offer by the Admiralty.

"In the event of this arrangement being carried out, it will, I believe, be better that the Council should not ask the Government for more than accommodation and rations for Mr. Gwyn Jeffreys and for a Junior Assistant whom he wishes to take with him; and that the Council should provide out of the Donation Fund the sum which will be required for the payment of the Assistant, and for providing the requisite supply of jars, spirit, &c. Mr. Jeffreys and I estimate this amount at £120.

"I would venture to suggest, therefore, that the Council should represent to the Admiralty the importance of taking advantage of this opportunity of carrying out a Physical and Biological exploration of the Deep Sea between the British Isles and Cape Farewell, and also in Baffin's Bay; and that the Admiralty be requested to institute a systematic series of Temperature Soundings, and to give such facilities as they may be able for deep dredging. Also that they provide accommodation and mess for Mr. Jeffreys and his Assistant.

"Believe me, dear Mr. President,

"Yours faithfully,

"WILLIAM B. CARPENTER."

"*Dr. Hooker, P.R.S.*"

"Resolved,—That a Letter be addressed to the Admiralty applying for accommodation and rations for Mr. Gwyn Jeffreys and his Assistant on board the 'Valorous' Store-ship in the Arctic Expedition; and that £120 from the Donation Fund be granted for payment of the Assistant and provision of materials."

[Copy.]

"Admiralty, 28th April, 1875.

"SIR,—With reference to your letter of the 15th instant, I am commanded by my Lord Commissioners of the Admiralty to acquaint you that there will be no objection to the Naturalist who may be selected by the Royal Society proceeding with his Assistant to Disco and back in H.M.S. 'Valorous,' and that the Lords Commissioners of H.M. Treasury have sanctioned the cost of naval rations for these gentlemen during the time they are absent with the ship; they will, however, be expected to defray certain mess expenses, and My Lords request it to be understood that any other expenses connected with these gentlemen accompanying the expedition cannot be borne by Government.

"2. I am at the same time to state that it is the desire of their Lordships, in acceding to the request of the Royal Society, that duplicates of

the specimens of Natural History obtained may be placed at the disposal of the Admiralty for transmission to the British Museum.

"I am, Sir,

"Your obedient Servant,

(Signed) "VERNON LUSHINGTON."

"*The Secretary to the Royal Society,
Burlington House.*"

2. The 'Valorous' is a paddle-wheel steamer of 1257 tons and 400 horse-power, commanded by Capt. Loftus F. Jones, and having a crew of 248, including officers, seamen, and marines. She carried six guns; but these had been taken out to make room for extra cabin accommodation and stores. We had a donkey-engine and a good supply of ropes, dredges, with nets, accumulators (or indicators), and various other apparatus for sounding, dredging, and collecting specimens. I was fortunate in being able to secure the services of Mr. Herbert P. Carpenter as my assistant. He is a son of Dr. Carpenter, and accompanied his father in the short deep-sea exploration of H.M.S. 'Lightning' in 1868. He was of the greatest assistance to me, and showed such scientific abilities of a high order, that I shall not be wrong in predicting for him a most successful and distinguished career as a naturalist. I would here also take the opportunity of acknowledging my sincere obligations to Capt. Jones, not only for his personal attentions, but for the highly satisfactory manner in which he carried out the scientific operations in the face of considerable difficulties. The other officers also deserve my best thanks for the unvaried kindness of their companionship.

3. On Saturday, the 29th of May, at 4 p.m., we left Spithead in company with the 'Alert' and 'Discovery.' Our vessel was deeply laden with coal and provisions for the other vessels; and while sailing we had some difficulty in keeping up with them. After touching at Cork to post letters for the squadron and take in more coal, and my going on board the 'Alert' at the entrance of Bantry Bay to greet my friends, Capt. Nares, Commander Markham, and Capt. Feilden (the naturalist), and to make the acquaintance of the other officers, we parted company with the Arctic ships on the 5th of June, and did not again rejoin them until we met at Disco on the 6th of July. On our passage we encountered very heavy weather, with strong persistent north-westerly winds, which greatly retarded our course, and made every one extremely uncomfortable. One day we gained 6 miles only, and another day lost 8. We had, in nautical phrase, "a regular dusting."

4. The only natural-history work we could do on the outward voyage was, during the intervals between storms, to use the towing-net. In latitude 58° 59' N., longitude 34° 13' W. (between 200 and 300 miles east of Cape Farewell), we caught some floating masses of pulpy greenish matter, which at first looked like an oceanic sponge, but has since been

made out by Professor Dickie to be an undescribed Diatom, and named by him *Synedra Jeffreysi*. An account of this remarkable organism will be appended to the Report. We afterwards found it covering to a considerable extent all that part of the North-Atlantic Ocean. It contained within its meshes numerous living *Globigerina* in different stages of growth, proving that *Globigerina* inhabits the surface of the sea. During one of the gales a wave larger than usual broke over the bow and washed on board a young cuttlefish of the same species (*Leachia borealis*, Steenstrup) as that which I had taken with the tow-net in the first cruise of the 'Porcupine' off the western coast of Ireland. Occasionally two tow-nets were put out at the same time, each at the end of a spar, with a guide-line. One of these spars was lashed to the cat-head of the bow anchor, and the other to the starboard paddle-box. The nets were thus kept clear of the ship's refuse and of the wash of the paddle. Attached to the stalk of a floating *Laminaria* was a cluster of the egg-capsules of *Buccinum Groenlandicum*, with the spawn of a Nudibranch (probably *Doris repanda*), *Spirorbis borealis*, and a sessile calcareous Polyzoon, besides countless numbers of a microscopic mite, which swarmed everywhere and appeared to be busily engaged in eating the outer layer of the seaweed as well as the spawn of the Nudibranch and the polyparies of the Polyzoon. This very curious parasitic mite could only be detected by the aid of a microscope. The oceanic Fauna and Flora offer a vast and inexhaustible field for scientific investigation.

5. Having entered Davis Strait and approached the "Boreæ finitimum latus," we met with several icebergs and a quantity of loose pack-ice, which must have been brought from East Greenland, if not from Spitzbergen, round Cape Farewell. We were obliged to give the pack-ice a wide berth; and, notwithstanding the greatest care, our paddles did not escape some damage. But I will not diverge from my biological text, nor say any thing about glacial phenomena; although I must confess that the beautiful and impressive spectacles of this nature which I witnessed in my voyage to the arctic regions both at sea and on land cannot be effaced from my memory. We had several showers of hail and snow; and on the night of the 3rd July the temperature of the air fell to $29\frac{1}{2}^{\circ}$ Fahr. or $2\frac{1}{2}^{\circ}$ below freezing-point. We reached Godhavn in Disco Island on the 4th of July, after a run of 37 days.

6. At Godhavn the rocks on the shore were covered with a stunted variety of *Littorina rudis*, closely resembling a variety of the same species which I found in brackish water on the banks of the river Deben near Sutton. The periodical melting of the ice and snow in Greenland would cause an admixture of fresh and salt water similar to that of the river-water and the sea on the coast of Suffolk. The arctic form has been considered a distinct species and named *Groenlandica* by Menke, Möller, and Mörch, *Davidi* by Bolten, and *castanea*

by Deshayes; Fabricius mistook it for the *Turbo littoreus* of Linné. It is the "Grönlandische Mondschncken" of Chemnitz. During our stay at Godhavn we dredged now and then in one of the ship's cutters at depths of from one to eighty fathoms. The results were to me very interesting; for opportunities were thus afforded me of observing in their native habitat the same arctic Mollusca which I had long studied at home in our posttertiary and glacial deposits. *Cardium Islandicum*, *C. Grœnlandicum*, and *Tellina calcaria* were the most common species at Godhavn and occurred at all depths. On the land I found *Vitrina pellucida* of Müller (*V. angelice*, Beck), not at the roots of *Archangelica officinalis*, but among moss and various water plants at the sides of small streams formed by the melting of ice. The pursuit of this branch of science was very disagreeable, by reason of the swarms of stinging gnats or mosquitoes which infested the low grounds. The weather was rainy and foggy, with occasional sunshine; the land was treeless and had a gloomy aspect. On the 13th of July the thermometer showed 78° in the sun; one day at Ritenbenk Kulbrud it was 81° in the midst of icebergs.

7. No time was lost at Godhavn in transferring the stores of coal and provisions to the Arctic ships; and we had also to give them some of our boats to replace those which had been lost in the gales on the outward voyage. All the ships left northward on the 15th of July; and after touching at the Danish settlement of Ritenbenk in Waigat Strait, we reached the Kulbrud, where we had to procure by digging a supply of coal, being a kind of lignite, from the Miocene strata which composed the cliffs. By dint of hard and continuous work 105 tons of this coal were got in the course of four days. We had a little boat-dredging in from 15 to 25 fathoms near the cliffs, among melting icebergs and the mud brought down by glacier-streams. There was no diminution of life. The Arctic ships here left us for their destination, and parting signals were exchanged. Mr. Clements Markham (who went out in the 'Alert' with his cousin, Commander Markham) came on board the 'Valorous' and made the return voyage with us. He was an agreeable accession to our small party in the Captain's cabin. Our position was at this time critical, in consequence of the narrowness of the Strait and the passage of numerous large icebergs. Some of these had been aground; but as they melted and became lighter they floated and whirled about the ship so as to endanger the paddles. We left at midnight on the 21st, and resumed our voyage northward, so as to get out of the Strait at the upper end of Disco Island.

8. On leaving the Strait we got our first dredging from the ship in lat. 70° 30' N., long. 54° 41' W., at a depth of 175 fathoms. The tangles or swabs brought up several beautiful specimens of *Asterophyton eucnemis* (*Asterias caput-Medusæ* of Fabricius), besides other starfishes; and the dredge had a goodly cargo of mud. The dredge weighed 78 lbs. When it was lowered a small guide-rope with a running noose or "guy" was

attached to the dredge-rope, and held by a man on the fore bulwark, in order to regulate the descent of the dredge and afterwards to assist in its being hoisted on board; and great care was taken that the swabs were let down before the dredge, so that they did not get into the mouth and choke it. Other particulars of a dredging-operation have been already given in the Preliminary Reports of the 'Porcupine' Expedition, and published in the 'Proceedings' of the Society. A small portion of the fore deck behind the capstan was enclosed by a sail and ropes for our sifting and examination of the mud; three large tubs made for this purpose, and nested or packed one within another for the convenience of stowage, were filled with sea-water; a tarpaulin was spread out, a seat and rough table provided, and our sieves (a nested set of five and a globe-sieve) were at once used to sift the mud. An array of basins, soup-plates, jam-pots, and glass bottles with other apparatus were in order on the table. Mr. Carpenter undertook the sifting, and I examined the results and reserved some of the animals for more leisurely description. The only Mollusca worth special notice were *Terebratella Spitzbergensis* and fragments of *Fusus Sabini* of Gray. At 4 p.m. we sounded and dredged again in 85 fathoms. The dredge came up empty; but on one of the swabs was a fine specimen of *Antedon Eschrichti*.

9. Steamed slowly down the eastern coast of Davis Strait, and dredged on the 28th in 100 fathoms, with no particular result as regards the Mollusca. The next day we dredged twice on the Upper Torske Bank (lat. $67^{\circ} 50' N.$, long. $55^{\circ} 27' W.$) in 20 fathoms, where a great many of the usual Arctic Mollusca were obtained. On the 26th dredged twice in 60 fathoms. These last two hauls were very productive, and yielded among other Mollusca the following species:—*Montacuta Dawsoni*, *Tellina inflata*, *Pilidium radiatum*, and several species of *Pleurotoma*, including *P. declivis* and a remarkable variety of *P. Trevelyana*, which I propose to name *Smithii*, after Mr. Edgar Smith of the British Museum.

10. My narrative must now allude, although briefly, to an anxious state of things which took place on the 27th of July, when we were about to enter the natural harbour of Holsteinborg for ballast. The weather was foggy, and we were therefore going slowly and cautiously under steam. Without our having any suspicion of danger we suddenly found ourselves stranded on a sunken reef of rocks about ten miles from Holsteinborg, which had not been laid down on the chart. The wind was freshening, and the ship was continually bumping and straining; but most providentially the tide was rising. After a suspense that lasted several hours the bow became free, and soon afterwards the ship floated and was got safe to Holsteinborg. I cannot sufficiently express my admiration of the prompt and skilful manner in which the Captain behaved in this trying emergency. My feelings at the time were those of intense disappointment; because I feared that, even if we escaped with our lives,

the scientific object for which I had undertaken such a long and uncomfortable voyage would probably be frustrated.

11. While the divers were at work under water examining the keel and timbers of the ship and fixing iron plates, and the carpenters were building a bulkhead at the bow, where the most dangerous leak existed, some of the officers went on shore trout-fishing; and Mr. Broad (the Navigating Lieutenant) most obligingly brought me specimens of two very curious kinds of Crustacea from a pool of fresh water in a neighbouring island, viz. *Apus glacialis* and *Branchipus paludosus*; the *Apus* is allied to the king crab or *Limulus*, and consequently to the extinct Trilobites. Mr. Carpenter and I had some boat-dredging in shallow water. *Rhynchonella psittacea* and *Pecten Islandicus** were here the most common Mollusca; and a living specimen of a new species of *Pleurotoma* (*P. rubescens*, J.) was discovered in 10 fathoms. This last-named species is described in the footnote†.

We left Holsteinborg on Sunday the 8th of August, and did not again touch land until we returned to Plymouth. I cannot omit here publicly thanking Inspector Krarup Smith, and Governors Fenske and Lassen, for the great kindness and hospitality shown by them at Godhavn, Ritenbenk, and Holsteinborg.

12. The variation of the compass is so great in these parts that the ship was steered in a north-westerly direction, although she was actually going south. We recrossed the arctic circle in 66° 32' N. lat. 10th August. Foggy, damp, and sunless. Thermometer 35° only. Sounded in 410 fathoms, took serial temperatures, and dredged. The results of this our first deep-sea dredging in Davis Strait were scanty, but interesting in every department of the marine Invertebrata. Among the Mollusca were *Eulima stenostoma* and *Fusus fenestratus*, both new to Greenland and having

* *Pecten Islandicus* is excellent eating, and not inferior to *P. maximus*, which is sold as a delicacy by our best fishmongers.

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*Pleurotoma rubescens*¹, Jeffr.

Body yellowish white; *tentacles* short; *eyes* small, on stalks which are united with the tentacles; *foot* long, squarish and double-edged in front, rounded behind; *canal-fold* short; *operculum* small, ear-shaped, and elongated.

SHELL oval, solid, opaque, of a dull hue: *sculpture*, rather strong, rounded but sharp and curved longitudinal ribs, which on the body-whorl extend to the suture and reach rather more than halfway down; there are twelve on each of the last two whorls; the whole surface is covered with numerous fine, irregular, impressed spiral striæ, which cross the ribs; the uppermost whorls are fretted: *colour* pale purplish red: *spire* short, ending in a somewhat abrupt and blunt point: *whorls* 5-6, convex, regularly increasing; the last occupies about three fifths of the shell: *suture* deep: *mouth* oval, rather wide; length rather exceeding one half that of the shell: *canal* short, wide, nearly straight: *outer lip* flexuous, slightly incurved, with a sharp edge: *labial notch* shallow and indistinct, placed near the top of the body-whorl: *inner lip* broad, somewhat excavated, and polished: *pillar* flexuous. Length 0.35; breadth 0.125.

One specimen only, from 10 fathoms at Holsteinborg. Unlike any European or North-American species.

Inclined to blush.

a range of distribution from Norway to the Bay of Biscay. Caught by the tangles was a fine Gorgonian, which Mr. Norman considers a new species of *Mopsea*. The bottom-temperature was $34^{\circ}6$. Next day we sounded, and dredged in 1100 fathoms. A live specimen of that remarkable Brachiopod *Atrétia gnomon*, besides other Mollusca familiar to me from the 'Porcupine' expeditions (e.g. *Nucula reticulata*, J., *Limopsis aurita*, *Axinus eumyariius*, and *Dentalium candidum*, J.), were scientifically important captures.

13. Sounded on the 12th of August in 1350 fathoms; but no dredging, because the wind was fair. All the pumps were obliged to be kept going day and night. If a small brig had been in the first instance despatched to Disco with a supply of coal for the Polar Expedition we need not have entered Waigat Strait, and lost so much time in digging fuel of an inferior quality on an exposed and dangerous coast, nor have thus unnecessarily consumed our own provisions; and as ballast could have been taken in at Godhavn, the unfortunate accident which crippled the ship might have been avoided. In that case the instructions of the Admiralty, in compliance with the request of the Society for scientific investigations, could have been completely and satisfactorily carried out.

14. Sounded and dredged on the 14th of August in 1750 fathoms, at the entrance of Davis Strait. The dredge brought up nearly 3 cwt. of soft yellowish-brown mud. The Mollusca comprised *Siphonodentalium vitreum*, *S. Lofotense*, and several undescribed forms, most of which I had found at less depths in the 'Porcupine' Expedition of 1869. A remarkable new genus of Echinoidea occurred, which I at first took to be a *Pourtalesia*; but Mr. Norman will give an account of it, as well as of a Crustacean (*Leucon longirostris*) which Dr. Sars described from a fragment procured in the 'Josephine' Expedition off the Straits of Gibraltar. Dr. McIntosh has also made out a new genus of Annelids under the name of *Tachytrypane*.

15. We now got into the Atlantic, and on the 16th and 17th of August took soundings in 1660 and 1860 fathoms. On the 19th sounded and dredged in 1450 fathoms. The bottom-temperature was $36^{\circ}3$, being nearly two degrees higher than in 410 fathoms off Godthaab in Davis Strait. A large stone, as big as a man's head, came up on the weights above the dredge, but unfortunately fell off before the weights were brought on board. Let the submarine telegraph companies look to this! The mud in the dredge contained a great many small stones, to one of which was attached a living and beautiful specimen of *Discina Atlantica*. There were also a new species of *Terebratula* (*tenera*, J.), fragments of *Atrétia gnomon*, *Amussium* (*Pleuronectia*) *lucidum*, *Lima ovata* (a Coralline-Crag and Monte-Mario fossil), *Dacrydium vitreum*, *Leda acuminata*, many of the 'Porcupine' deep-water species (including an undescribed species of the curious genus *Fissurisepta*), *Malletia excisa*

(Norway and West of Ireland, and fossil in Sicily), and an exquisite species of a new genus which I will name *Seguenzia*, and presently describe. The last is likewise a Sicilian fossil, and was found by me in the 'Porcupine' Expedition of 1870 off the Atlantic coasts of Spain and Portugal. Dr. McIntosh notes a new and remarkable species of *Ditrypa*, and Mr. Norman several interesting Crustacea, Foraminifera, and a Sponge.

16. 20th August. Fine and sunshiny, with a calm sea. A sounding in lat. $56^{\circ} 1' N.$, $34^{\circ} 42' W.$, gave 690 fathoms only. Surface temperature 53° , bottom $38^{\circ} 2$. Dredged here and got *Discina Atlantica*, *Leda acuminata*, *Limopsis minuta* (*borealis*, Woodward), *Fusus Berniciensis*, and *Scaphander puncto-striatus* (*librarius*, Lovén), besides some of the 'Porcupine' novelties, such as *Dentalium capillosum*, J., *Fusus attenuatus*, J., and another species of *Seguenzia* hereafter noticed as *carinata*. The *Dentalium* had been also dredged by Count Pourtales in the Gulf of Mexico, and since in the 'Challenger' Expedition. There were likewise fragments of a volcanic or igneous rock (which, according to Mr. Etheridge, came probably from Iceland) as well as stones in the dredgings from 1750 and 1450 fathoms. The great difference of depth in the same track between the last and next sounding (1450 : 690 : 1230) was very striking; and we almost fancied that we had got on the sunken land of Buss. (See Dr. Wallich's 'North-Atlantic Sea-bed.') But a more likely explanation may be, that the intermediate and shallowest depth represents a submarine ridge corresponding with that discovered in the 'Bulldog' (viz. 1168 : 748 : 1260) between 59° and $60^{\circ} N.$ lat. The fauna appeared to be the same on each side of the ridge. We sounded the next two days in 1230 and 1485 fathoms.

17. Our last sounding and dredging were made on the 23rd of August in 1785 fathoms. The sifting of a good load of ooze did not yield much. More fragments of *Atrétia gnomon*, *Malletia excisa*, *Axinus Croulinensis*, *A. ferruginosus*, and the fry of *Isocardia cor*, with a few of the 'Porcupine' deep-water species, were the principal results in the Mollusca. Mr. Norman reports some undescribed Echinodermata, Isopoda, and Ostracoda; and Dr. McIntosh a second species of his genus *Tachytrypa* under the name *arctica*. The following day another Atlantic gale came on, with violent squalls; the water in the dam increased from 3 feet 10 inches to 8 feet; and we were battened down. This stopped all further scientific exploration; but eleven out of twenty stations in the Admiralty programme had been examined, and we had nearly joined the soundings westward of Ireland obtained in the 'Porcupine.' We returned home safely on the 29th of August, after a rather eventful cruise of three months.

It is hoped that the scientific work thus done has not been unprofitable, and that it may in some measure serve to supplement the farther exploration of the 'Challenger,' which did not extend north

of our parallel. We have had a mere glimpse of that "wonderland" which underlies the vast ocean; and our curiosity is very far from being satisfied, especially as regards the arctic seas. It is a new world, full of interest not only to naturalists but to every man of science.

Although we have of late years done a great deal to promote submarine researches, as shown by the expeditions of H.M.S.S. 'Lightning,' 'Porcupine,' 'Shearwater,' 'Challenger,' and 'Valorous,' our comparatively poor neighbours in Scandinavia have been earlier in the field and not less energetic. From the 'Notices sur la Suède,' published on the occasion of the International Congress of Geographical Sciences in 1875 at Paris, it appears that between the years 1837 and 1875 seventeen scientific expeditions were made from Sweden, of which fifteen explored the arctic regions. Professors Lovén, Torell, and Nordenskiöld, with other distinguished naturalists, took an active part in these expeditions. The sister kingdom of Norway has now engaged in the same course of discovery; and a well-equipped Government expedition has within the last few days set out from Bergen, with the view of examining the region of sea surface and bottom bounded by Norway, the Shetlands, Färöes, Iceland, East Greenland, Jan Mayen, and Spitzbergen. This will be done during the present and the next year or two. Dr. G. O. Sars (son of the late Professor Sars and a zoologist of great reputation) is the naturalist in charge of the Norwegian expedition; and the harvest is sure to be abundant and valuable.

But after all it must be borne in mind that if every civilized nation in the world were every year during the next century to send out similar expeditions, with improved appliances for exploring the sea-bed, the field would be far from being exhausted. Every such expedition must be more or less tentative, and can only form the basis for a more complete investigation of "the deep bosom of the ocean." The area of this must be measured by many millions of square leagues; whereas all that has hitherto been effected has been to scrape in an imperfect manner the surface of a few scores of acres.

My attention has been directed exclusively to the Mollusca. Indeed I could not have prepared this Report but for the valuable assistance which has been kindly given me by naturalists who have specially studied other groups of the marine Invertebrata. Mr. Norman has worked out the Crustacea, Tunicata, Polyzoa, Echinodermata, Actinozoa, Foraminifera, Polycystina, and Sponges, Dr. M'Intosh the Annelida, Professor Allman the Hydrozoa, Professor Duncan the Corals, and Professor Dickie the Diatoms. Dr. Carpenter has undertaken the report of the physical results, and to complete the examination of the Foraminifera.

MOLLUSCA.

The total number of marine species procured during the 'Valorous' cruise was 181, viz. 122 in Davis Strait, and 59 in the North Atlantic, besides fragments of several undetermined species. The most complete and modern list of Greenlandic species is that which Dr. Mörch, the eminent conchologist of Copenhagen, prepared for the Manual of 'The Natural History, Geology, and Physics of the Arctic Regions, 1875.' This Manual was published by authority of the Lords Commissioners of the Admiralty for the use of the North-Polar Expedition. Dr. Mörch's list gives 155 marine species from Greenland, after deducting doubtful species and varieties. I am now enabled to add to that list 33 species, viz. 21 already described, and 12 undescribed or new. These last, with one exception (*Pleurotoma rubescens*), were from depths exceeding 1000 fathoms. I obtained altogether from Davis Strait and the North Atlantic no fewer than 37 undescribed species (Brachiopoda 2, Conchifera 16, Sole-noconchia 7, Gastropoda 11, Pteropoda 1, Cephalopoda 0), all except the *Pleurotoma* from great depths. The only land-shell which occurred to me in Greenland was *Vitrina pellucida*, Müller, = *V. angelicæ* (Beck), Möller, which is a native of all the four old quarters of the globe. Several species from deep water were familiar to me from my dredgings in the 'Porcupine' off the west of Ireland and in the Bay of Biscay, as well as from the newer tertiary deposits in Sicily—thus showing a range of distribution from 56° to 38° N. lat., or between 1200 and 1300 miles. One of the most remarkable instances of such distribution, both in space and time, consisted in the rediscovery in comparatively high latitudes of two exquisite and peculiar species which cannot be referred to any known genus, and for which I will propose the name of *Seguenzia*, in honour of my friend Signor Seguenza, Professor of Geology and Palæontology at Messina. The genus evidently belongs to the *Solarium* family, but is distinguished by having a broad and deep open furrow (rather than a cleft) in the upper part of the last whorl. I have three species, all undescribed (*S. formosa*, *S. elegans*, and *S. carinata*), the first of which has no umbilicus, the other two being deeply umbilicated. The newer Tertiaries of Sicily also contain several other species of northern Mollusca in a fossil state which do not appear to inhabit the Mediterranean. Some of these (e.g. *Mya truncata*, *Saxicava Norvegica*, and *Buccinum undatum*) are comparatively shallow-water species; and as their transport or migration southwards cannot be accounted for by the action of deep submarine currents, it is difficult to conceive how they could have lived in that part of the Mediterranean where Sicily now stands, unless the climate of that region had changed in the same way as must have been at one time the case in Great Britain. Possibly the North Pole may formerly have been placed in Scotland!

The consideration of the Mollusca in Davis Strait gives rise to

a curious and interesting question as to whether the Greenlandic fauna is European or American. According to the learned President of the Royal Society, the flora of Greenland is European (see page 198 of 'The Natural History, Geology, and Physics of the Arctic Regions, 1875'). My examination of the Mollusca in the North Atlantic, from Norway and Spitzbergen to the United States, as well as in Davis Strait, induces me to extend Dr. Hooker's opinion to the marine Invertebrate fauna; and Dr. McIntosh concurs with me in this as to the Annelida. Another of my colleagues, the Rev. A. M. Norman, believes, on the other hand, that the fauna of Davis Strait is American and not European, because out of 30 species of Echinodermata procured during the cruise of the 'Valorous,' 27 are American and 21 only are European, and out of 15 stalk-eyed Crustacea 13 are American and 11 only are European. In the other classes of the Crustacea, as well as in all the remaining orders of Invertebrata examined by him, the percentage is largely in favour of the fauna being European. The Mollusca on the eastern coasts of the United States have been most assiduously and carefully worked out by a host of able conchologists during more than half a century, and especially of late years by Professors Stimpson and Verrill and Mr. Whiteaves; so that I do not imagine that many more species remain to be gleaned on those coasts. Now the accompanying lists which I have prepared show that there are 116 North-American species which have not occurred on the coasts of Greenland nor in the European seas; that 52 other species are Greenlandic and European, not American; that 39 others are American and European, not Greenlandic; that only 3 others are American and Greenlandic, not European; and that 5 others are exclusively Greenlandic, and not American nor European. The total number of species from the north-eastern coasts of America is about 400. The result therefore shows very decidedly that the Mollusca of Greenland are more European than American, and implies that the course of migration has been in a westerly and not easterly direction.

Besides the examination of the shells of Mollusca I had an opportunity of examining and describing the "animals" or soft parts of 58 species, including such rare and peculiar forms as *Atrétia gnomon*, *Discina Atlantica*, *Menestho* (not *Monopterygma*) *albula*, and *Pilidium radiatum*. I may here mention that I watched for a long time and on different occasions living specimens of *Rhynchonella psittacea*, with their valves opening and opened; but I could never detect any cilia (much less the arms) protruding. *Buccinum Greenlandicum* takes in Davis Strait the place of our common *B. undatum*; its odontophore is very different, and, according to Mr. Jabez Hogg, the formula of *B. Greenlandicum*, var. *sericata*, is 3.4.3, that of *B. undatum* being 4.7.4.

I will add diagnoses of three new genera, *Atrétia*, *Glomus*, and *Sequenzia*. The new species will be described elsewhere.

MOLLUSCA,

Greenlandic and European, not American.

From the 'Valorous' Cruise.

- | Names and Synonyms. | Habitats and Remarks. |
|--|--|
| 1. <i>Montacuta Dawsoni</i> , Jeffreys .. | Aberdeenshire and west of Ireland; Christianiafiord: 'Porcupine' Expedition, 1870 (off Cape Sagres), 45 fathoms. |
| 2. <i>Axinus eumyrius</i> , Sars | Norway (Sars): Porc. Exp. 1870 (Bay of Biscay), 227-740 fms. |
| 3. <i>Cardium elegantulum</i> , Möller.. | Norway (Sars and McAndrew). |
| 4. <i>Trochus umbilicalis</i> , Broderip and Sowerby (<i>Margarita</i>). Not <i>Margarita Groenlandica</i> , var., to which Mörch refers it. | Wellington Channel (Belcher): Spitzbergen (Eaton). |
| 5. <i>Pilidium radiatum</i> , Sars, 1850 (<i>Capulus</i> afterwards <i>Capulacmæa</i>), = <i>Pilidium commodum</i> , Middendorff, 1851, = <i>Piliscus commodus</i> and <i>P. probus</i> , Lovén, 1859, = <i>Capulus dilatatus</i> and <i>C. depressus</i> , A. Adams, 1860 and 1864. | Norway (Sars): Sea of Okhotsk (Middendorff): Spitzbergen (Torell): Japan (A. Adams): Aleutian Isles, N. Pacific (Dall): Udevalla, fossil (J. G. J.): Moray Firth, semifossil (Robert Dawson): Montreal, fossil (Principal Dawson). |
| 6. <i>Aporrhais Serresianus</i> , Michaud, 1828 (<i>Rostellaria</i>), var., = <i>A. pescarbonis</i> , Forbes and Hanley (not Brongniart), 1853, = <i>A. Macandrea</i> , Jeffr. 1867. | Fragments only. Not <i>A. occidentalis</i> . Norway, Shetland, Ireland, Bay of Biscay, and Mediterranean, 45-1230 fathoms. |
| 7. <i>Fusus fenestratus</i> , Turton, 1834, = <i>Buccinum fusiforme</i> , Broderip, 1829 (specific name inappropriate). | South of Ireland: Norway: Porc. Exp. 1869, 200-1630 fathoms; 1870, 220-718 fathoms. |
| 8. <i>Pleurotoma elegans</i> , Möll. (<i>Defrancia</i>), 1842, = <i>P. elegantior</i> , S. Wood, 1872. | Iceland (Torell): Porc. Exp. 1869, 560 fathoms. |
| 9. — <i>declivis</i> , Lovén (<i>Tritonium</i>). | Norway: Porc. Exp. 1869, 64-345 fms.; 1870, 507 fms. |
| 10. — <i>cinerea</i> , Möll. (<i>Defrancia</i>). | Spitzbergen (Torell): Porc. Exp. 1869, 290 fathoms. |
| 11. — <i>viridula</i> , Möll. (<i>Defrancia</i>). | Porc. Exp. 1869, 560 fathoms. |

Oceanic.

12. *Olio pyramidata*, Browne North Atlantic.

Deep Water.

13. *Atrertia gnomon*, Jeffr. 1100-1785 fms.: Porc. Exp. 1869, 1380-1443 fms.: North-Atlan-

Names and Synonyms.	Habitats and Remarks.
	tic cable, 2400 fms. (Sir James Anderson).
14. <i>Pecten fragilis</i> , Jeffr.	1450-1785 fms.; fragments.
15. <i>Lima gibba</i> , Jeffr.	1450-1785 fms.
16. <i>Nucula reticulata</i> , Jeffr. (not <i>Leda reticulata</i> , Hinds).	1100 fms.: Porc. Exp. 1869, 1180-1476 fms.: 'Challenger' Exp., off Azores, 1000 fms.
17. <i>Leda pusio</i> , Philippi, var. <i>latior</i> .	1450-1750 fms.: Porc. Exp. 1869, 1180-1215 fms.; 1870, 257-994 fms.: Sicilian and Calabrian Tertiaries.
18. ——— <i>acuminata</i> , Jeffr.	690-1750 fms.: Porc. Exp. 1869, 422-862 fms.; 1870, (Bay of Biscay) 45-1095 fms., (Mediterranean) 92-1456 fms.: Mediterranean, 40-120 fms. (Carpenter); 200-300 fms. (Nares); 310 fms. (Spratt); 230 fms. (Sir James Anderson): 'Challenger' Exp., Setubal Bay, 470 fms.; off Azores, 450 and 1000 fms. Fossil at Messina (Sequenza, as <i>L. Messanensis</i> , MS.). Perhaps the latter specific name ought to be substituted for mine, because Von Buch had previously described a Liassic species of <i>Leda</i> (his <i>Nucula acuminata</i>), and his name has been adopted by palæontologists.
19. ——— <i>expansa</i> , Jeffr.	1450-1750 fms.: Porc. Exp. 1869, 1180-1380 fms.
20. ——— <i>lata</i> , Jeffr.	1750 fms.: Porc. Exp. 1869, 165-1443 fms.; 1870, 740-1095 fms.: 'Challenger' Exp., off Azores, 1000 fms.
21. <i>Glomus nitens</i> , Jeffr.	1750 fms.: Porc. Exp. 1869, 557-1476 fms.
22. <i>Limopsis aurita</i> , Brocchi	1100 fms.: Shetland: Wellington Channel (Belcher): Porc. Exp. 1869, 155-458 fms.; 1870, (Bay of Biscay) 220-690 fms., (Mediterranean) 92 fms.: 'Lightning' Exp. 189 fms.
23. <i>Malletia cuneata</i> , Jeffr.	1450-1750 fms.: Porc. Exp. 1869, 1215-1443 fms.; 1870, (Bay of Biscay) 718-1095 fms., (Mediterranean) 1415 fms.

Names and Synonyms.

Habitats and Remarks.

24. *Axinus cycladius*, S. Wood (*Kel-
lia*). 1750 fms.: Shetland (J. G. J.):
Porc. Exp. 1870, 386 fms.:
Mediterranean, 30-40 fathoms
(Nares), 100 fms. (Spratt), 40-
120 fms. (Carpenter).
25. — *incrassatus*, Jeffr. 1750 fms.; also in North At-
lantic, 1450 and 1785 fms.
26. *Dentalium candidum*, Jeffr. . . . 1100 fms.: Porc. Exp. 1869
(Bay of Biscay), 2435 fms.:
'Challenger' Exp., off Azores,
450 and 1000 fms.

*From Dr. Mörel's List, the Copenhagen Museum,
and other authorities.*

27. *Leda tenuis*, Philippi, 1836 (*Nu-
cula*), = *Nucula lenticula*, Möll.,
= *Nucula pygmaea* (v. Mün-
ster?), Ph. 1844 (not v. Mün-
ster's species). British and Scandinavian, 20-300
fms.: Gulf of Gascony, 40-80
fms. (Marquis de Folin): Porc.
Exp. 1869, 96-1630 fms.; 1870,
(Bay of Biscay) 128-1095 fms.,
(Mediterranean) 40-1456 fms.:
'Lightning' Exp. 189-650 fms.:
Mediterranean, 40-120 fms.
(Carpenter), 30-300 fathoms
(Nares), 130-310 fms. (Spratt).
28. — *abyssicola*, Torell. Wellington Channel (Belcher):
Spitzbergen (Torell): Norway
(G. O. Sars): Shetland (J. G.
J.): Porc. Exp. 1869, 165-
862 fms.; 1870, 304-717 fms.
29. — *intermedia*, Sars Wellington Channel (Belcher):
Norway (Sars): Spitzbergen
(Torell): Shetland (J. G. J.).
30. *Arca glacialis*, Gray, 1824, = *A.
obliqua*, Philippi, 1844, = *A. lac-
tea*, Malm, 1853 (non Linné), =
A. Korenii, Danielssen, 1859. Wellington Channel (Belcher):
Spitzbergen (Torell): Scandi-
navia (Malm and others):
Shetland (J. G. J.): Porc. Exp.
1869, 64-422 fms.; 1870, (Bay
of Biscay) 45-58 fms., (Medi-
terranean) 92-1456 fms.: Me-
diterranean, 95 fms. (Acton),
30-300 fms. (Nares), 30-120
fms. (Carpenter), 100-250 fms.
(Spratt).
31. *Astarte Warhami*, Hancock, 1846,
= *A. fabula*, Reeve, 1855. Davis Straits (Hancock): Wel-
lington Channel (Belcher):
Greenland (Verkrüzen): Spitz-
bergen (Torell and Eaton).
32. *Pecchiolia abyssicola*, Sars Davis Straits (Mus. Copenhagen):
Baffin's Bay, 199-336 fms.

Names and Synonyms.	Habitats and Remarks.
	(Lindahl): Norway (Sars): Porc. Exp. 1869, 557-670 fms.; 1870 (Bay of Biscay), 567 fms.
33. <i>Neæra cuspidata</i> , Olivi	Greenland (Wallich, <i>vide</i> Mörch): Spitzbergen (Torell): British, Scandinavian, and Mediterranean.
34. <i>Cliton cinereus</i> , Linné	Greenland (Mörch): British and Scandinavian; Heligoland: Bay of Biscay: 'Lightning' Exp. 189-530 fms.
35. <i>Lacuna puteolus</i> , Turt.	Greenland (Möller, as <i>L. palli- dula</i>): British, Scandinavian, and Icelandic: 'Lightning' Exp. 530 fms.
36. — <i>crassior</i> , Montagu, 1803 (<i>Turbo</i>), = <i>L. glacialis</i> , Möller, 1842.	Greenland (Möller): Spitzbergen, 5-12 fms. (Torell): British, N. France, N. Pacific.
37. <i>Rissoa scrobiculata</i> , Möller	Greenland (Möller and J. G. J.): Spitzbergen (Torell).
38. — <i>cimicoides</i> , Forbes, = <i>R. in- termedia</i> , Aradas.	Greenland (Barrett), coll. M'And- rew.
39. <i>Homalogyra rota</i> , Forbes and Hanley (<i>Skenea</i> ?).	Off Hamilton's Inlet, 1622 fms. (Wallich): British, Scandina- vian, Mediterranean, and Ma- deiran.
40. <i>Aclis Walleri</i> , Jeffr.	Off Hamilton's Inlet, 1622 fms. (Wallich): British, Scandina- vian, Mediterranean.
41. <i>Velutina lanigera</i> , Möller	Greenland (Möller): Norway (Sars).
42. — <i>plicatilis</i> , Müller, 1776 (<i>Bulla</i>), = <i>Bulla flexilis</i> , Mont. 1808.	Greenland (coll. Möller in Mus. Copenh.): British and Scandi- navian: Iceland (Steenstrup): N. Pacific (Middendorff).
43. <i>Trichotropis conica</i> , Möller	Greenland (Möller): Oxfjord, Finmark, 40-100 fms. (Sars).
44. <i>Buccinum Belcheri</i> , Reeve	Wellington Channel (Belcher): Vadsö, Finmark (Verkrüzen).
45. <i>Fusus lachesis</i> , Mörch, 1869, = <i>Tritonium terebrale</i> , Sars, MS. Not <i>Neptunea terebralis</i> , Gould, which is <i>F. Spitzbergensis</i> of Reeve.	Greenland, 80 fms. (Olrik, <i>vide</i> Mörch): Norway (Sars): Porc. Exp. 1869, 440 fms.
46. — <i>tortuosus</i> , Reeve, 1855, = <i>F. Sabini</i> (Gray), Hancock, 1846. Not <i>Buccinum (Fusus)</i> <i>Sabinii</i> , Gray.	Wellington Channel (Belcher): Spitzbergen (Torell): Norway (Verkrüzen).

- | Names and Synonyms. | Habitats and Remarks. |
|---|--|
| 47. <i>Fusus propinquus</i> , Alder | Greenland (Mörch): East Greenland (Möbius): British and Scandinavian: Porc. Exp. 1869, 66-1230 fms.; 1870 (Bay of Biscay), 109-1380 fms.: 'Lightning' Exp., 189-530 fms. |
| 48. — <i>Islandicus</i> , Chemnitz, 1780 (<i>Murex</i>), = <i>Tritonium antiquum</i> , Fabricius, 1780 (non Linné). | Greenland (Fabricius and others): Icelandic, Scandinavian, and British, 30-300 fms.: Gulf of Gascony (Lafont): Porc. Exp. 1869, 85-155 fms. |
| 49. <i>Mitra Grœnlandica</i> (Beck), Möll. | Greenland (Möller): Baffin's Bay (Gray): Wellington Channel (Belcher): Porc. Exp. 1869, 200-420 fms. |
| 50. <i>Utriculus expansus</i> , Jeffr. | Greenland (Torell and Mus. Copenhagen): Norway (Sars and others): Shetland (J. G. J.): Porc. Exp. 1869, 542-670 fms. |
| 51. <i>Philine scabra</i> , Müll., 1788 (<i>Bulla</i>), = <i>Bullœa punctata</i> , Möll., 1842 (non Clark). | Greenland (Möller): British coasts, Iceland, Scandinavia, Bay of Biscay, and Mediterranean: Porc. Exp. 1870 (Mediterranean), 92 fms. |
| 52. <i>Leachia hyperborea</i> , Steenstrup . | Greenland (Mörch): Porc. Exp. 1869, and 'Valorous' in North Atlantic. |

MOLLUSCA,

Greenlandic and North-American, not European.

- | | |
|---|--|
| 1. <i>Amaura candida</i> , Möll. | Greenland (Möller and others): Gulf of St. Lawrence (Whiteaves). |
| 2. <i>Fusus Krøyeri</i> , Möll. | Greenland (Holböll and Barrett): Labrador (Stimpson): Murray Bay (Principal Dawson). |
| 3. <i>Æolis Bostoniensis</i> , Couthouy . . | Greenland (Olrik, <i>teste</i> Mörch). "Approaching closely <i>Æolis coronata</i> of Forbes," which is European. |

Greenlandic, not North-American nor European.

- | | |
|--|--|
| 1. <i>Trochus Vahlî</i> , Möll. (<i>Margarita</i>). | Greenland (Möller and others). |
| 2. <i>Acirsa Eschrichti</i> , Möll. (<i>Scalaria</i>). | Greenland (Möller and others). Fossil at Uddevalla and on the coasts of Aberdeenshire and Antrim. <i>Acirsa</i> differs from <i>Scalaria</i> in sculpture, form of |

Names and Synonyms.

Habitats and Remarks.

the mouth, and apex. *S. subdecussata* of Cantraine also belongs to the genus *Acirsa*.

3. *Pleurotoma rubescens*, Jeffr., sp. n. Holsteinborg, 10 fms. (J. G. J.).

(From Deep Water.)

4. *Kellia symmetros*, Jeffr., sp. n. . . Davis Straits, 1750 fms. (J. G. J.).
A single specimen.
5. *Utriculus substriatus*, Jeffr., n. sp. Davis Straits, 1750 fms. (J. G. J.).
Fragments only; but evidently belonging to an undescribed species allied to *U. expansus*, which is quite smooth.

MOLLUSCA,

North-American and European, not Greenlandic. (See the second edition of Gould's 'Invertebrata of Massachusetts,' and the Reports of the British Association for 1872.)

Names of Species.

Synonyms and Remarks.

1. *Teredo navalis*, Linné.
2. — *Norvegica*, Spengler.
3. — *pedicellata*, Quatrefages.
4. *Pholas crispata*, L.
5. *Solen ensis*, L.
6. *Solenomya togata*, Poli, 1791 *Solemya velum*, Say, 1822; *Solemya borealis*, Totten, 1834.
(*Tellina*).
7. *Nacera pellucida*, Stimpson.
8. *Kellia suborbicularis*, Montagu
(*Mya*).
9. *Lucina borealis*, L. (*Venus*).
10. *Cardita sulcata*, Bruguière, 1792; *C. borealis*, Conrad, 1836.
var.
11. *Mytilus modiolus*, L.
12. *Anomia ephippium*, L., and vars.
13. *Philinelima*, Brown, 1827 (*Bulla*). *Bulla lineolata*, Couthouy, 1839.
14. *Scaphander puncto-striatus*, Mighels and Adams, 1842 (*Bulla*). *S. librarius*, Lovén, 1846.
15. *Polycera Lessoni*, D'Orbigny.
16. *Doris tuberculata*, Cuvier, 1802. *D. diademata*, Ag., 1870.
17. *Dendronotus arborescens*, Müller
(*Doris*).
18. *Doto coronata*, Gmelin (*Doris*).
19. *Æolis papillosa*, L. (*Limax*).
20. — *rufibranchialis*, Johnston
(*Eolidia*).

Names of Species.	Synonyms and Remarks.
21. <i>Æolis picta</i> , A. & H.	
22. — <i>despecta</i> , Johnston.	
23. <i>Chiton marginatus</i> , Pennant. . . .	<i>C. cinereus</i> , Gould (not L.). A doubtful identification.
24. — <i>mendicarius</i> , M. & A., 1842.	Described as "one inch long and four inches broad"! <i>C. Hanleyi</i> (Bean), Thorpe, 1844, sec. spec. Americ.
25. <i>Dentalium striolatum</i> , St., 1851 (<i>Entalis</i>).	<i>D. abyssorum</i> , Sars, 1858.
26. <i>Crepidula fornicata</i> , L. (<i>Patella</i>).	
27. <i>Ianthina communis</i> , Lamarck . .	Oceanic, and questionably indigenous.
28. <i>Trochus obscurus</i> , Couth. (<i>Margarita</i>).	
29. — <i>varicosus</i> , M. & A., 1842 (<i>Margarita</i>).	<i>M. elegantissima</i> (Bean), S. Wood, 1848.
30. <i>Hydrobia ventrosa</i> , Mont., 1803; var. (<i>Turbo</i>).	<i>Rissoa minuta</i> , Tott., 1834.
31. <i>Littorina litorea</i> , L. (<i>Turbo</i>).	
32. <i>Cerithiopsis tubercularis</i> , Mont., 1803 (<i>Murex</i>).	<i>Cerithium Greenei</i> , Ad., 1839.
33. — <i>trilineata</i> , Philippi, 1836 (<i>Cerithium</i>).	<i>Cerithium terebrale</i> , Ad., 1841.
34. <i>Odostomia impressa</i> , Say, 1822. .	<i>O. cœlata</i> , Cailliaud, 1865.
35. — <i>interrupta</i> , Tott., 1834 (<i>Turritella</i>).	<i>Melania rufa</i> , Ph., 1836 (afterwards <i>Chemnitzia</i>).
36. <i>Bulbus Smithii</i> , Br., 1839 (<i>Natica</i>).	<i>Natica flava</i> , Gd., 1840; <i>N. aperta</i> , Lov., 1846.
37. <i>Trophon muricatus</i> , Mont. (<i>Murex</i>).	Doubtful as American; perhaps <i>T. truncatus</i> , Ström.
38. <i>Melampus myosotis</i> , Draparnaud (<i>Auricula</i>).	
39. <i>Cavolina trispinosa</i> , Lesueur (<i>Hyalæa</i>).	Oceanic.
39, including 2 oceanic.	

MOLLUSCA

inhabiting the eastern coasts of North America, which have not occurred on the coasts of Greenland nor in the European seas.

(See the second edition of Gould's 'Invertebrata of Massachusetts,' 1870, and my communication to the British Association in 1872, "On the Mollusca of Europe compared with those of Eastern North America.")

Names of Species.	Synonyms and Remarks.
1. <i>Teredo Thompsonii</i> , Tryon.	
2. <i>Xylotrypa fimbriata</i> , Jeffreys.	

Names of Species.	Synonyms and Remarks.
3. <i>Pholas costata</i> , Linné.	
4. — <i>truncata</i> , Say.	
5. <i>Solecuretus gibbus</i> , Spengler.	
6. — <i>divisus</i> , Sp.	
7. <i>Siliqua squama</i> , Blainville.	
8. — <i>costata</i> , Say.	
9. <i>Corbula contracta</i> , Say.	
10. <i>Pandora trilineata</i> , Say.	
11. <i>Lyonsia hyalina</i> , Conrad.	
12. <i>Anatina papyracea</i> , Say.	
13. <i>Thracia Leana</i> , Conr.	
14. — <i>Conradi</i> , Couthouy.	
15. — <i>septentrionalis</i> , Jeffr.	
16. <i>Mactra solidissima</i> , Chemnitz.	
17. — <i>lateralis</i> , Say.	
18. <i>Cumingia tellinoïdes</i> , Conr.	
19. <i>Mesodesma deauratum</i> , Turton.	
20. <i>Petricola pholadiformis</i> , Lamarek.	
21. <i>Tellina tenta</i> , Say.	
22. — <i>tenera</i> , Say.	
23. <i>Lucina dentata</i> , Wood.	
24. <i>Astarte castanea</i> , Say ; and var. (<i>quadrans</i>).	
25. <i>Crassatella mactracea</i> , Linsley.	
26. <i>Venus convexa</i> , Say.	
27. — <i>mercenaria</i> , L. ; and young (<i>gemma</i>).	
28. <i>Gemma Manhattensis</i> , Prime.	
29. <i>Cardium Mortoni</i> , Conr.	
30. <i>Arca pexata</i> , Say.	
31. <i>Nucula proxima</i> , Say.	
32. <i>Leda obesa</i> , Stimpson.	
33. — <i>myalis</i> , Couth.	
34. <i>Mytilus plicatulus</i> , Lam.	
35. <i>Crenella glandula</i> , Totten.	
36. <i>Pecten tenuicostatus</i> , Mighels and Adams.	
37. — <i>irradians</i> , Lam.	
38. <i>Ostrea Virginiana</i> , Lister.	
39. <i>Philine sinuata</i> , St.	
40. <i>Utriculus hyemalis</i> , Couth.	
41. — <i>canaliculatus</i> , Say.	
42. <i>Bulla incincta</i> , Migh.	
43. — <i>solitaria</i> , Say.	
44. <i>Actæon puncto-striatus</i> , Ad.	
45. <i>Doris tenella</i> , Agassiz.	

Names of Species.	Synonyms and Remarks.
46. <i>Doris grisea</i> , St.	
47. <i>Ancula sulphurea</i> , St.	
48. <i>Æolis pilata</i> , Gould.	
49. — <i>stellata</i> , St.	
50. — <i>purpurea</i> , St.	
51. — <i>diversa</i> , Couth.	
52. <i>Calliopæa</i> ? <i>fuscata</i> , Gd.	
53. <i>Embletonia fuscata</i> , Gd.	
54. — <i>remigata</i> , Gd.	
55. <i>Hermæa cruciata</i> , Alex. Ag.	
56. <i>Alderia Harvardiensis</i> , Ag.	
57. <i>Elysia chlorotica</i> , Ag.	
58. <i>Placobranchus catulus</i> , Ag.	
59. <i>Limapontia zonata</i> , St.	
60. <i>Chiton apiculatus</i> , Say.	
61. <i>Amicula Emersonii</i> , Couth.	
62. <i>Crepidula convexa</i> , Say.	
63. <i>Crucibulum striatum</i> , Say.	
64. <i>Rissoa sulcosa</i> , Migh.	
65. — <i>exarata</i> , St.	
66. <i>Littorina irrorata</i> , Say.	
67. <i>Scalaria lineata</i> , Say.	
68. — <i>multistriata</i> , Say.	
69. <i>Cæcum pulchellum</i> , St.	
70. <i>Vermetus radricula</i> , St.	
71. <i>Aporrhais occidentalis</i> , Beck.	
72. <i>Cerithium nigrum</i> , Tott.	
73. — <i>Emersoni</i> , Ad.	
74. <i>Triforis nigrocincta</i> , Ad.	
75. <i>Odostomia producta</i> , Ad.	
76. — <i>fusca</i> , Ad.	
77. — <i>dealbata</i> , St.	
78. — <i>modesta</i> , St.	
79. — <i>bisuturalis</i> , Say.	
80. — <i>seminuda</i> , Ad.	
81. — <i>nivea</i> , St.	
82. <i>Eulima oleacea</i> , Kurtz and St.	
83. <i>Natica heros</i> , Say.	
84. — <i>pusilla</i> , Say.	
85. — <i>immaculata</i> , Tott.	
86. — <i>duplicata</i> , Say.	
87. <i>Pleurotoma plicata</i> , Ad.	Different from <i>P. declivis</i> of Lovén, to which I had referred it, judging from description only.

Names of Species.	Synonyms and Remarks.
88. <i>Columbella avara</i> , Say.	
89. — <i>dissimilis</i> , St.	
90. — <i>lunata</i> , Say.	
91. <i>Nassa obsoleta</i> , Say.	
92. — <i>trivittata</i> , Say.	
93. — <i>vibex</i> , Say.	
94. <i>Urosalpinx cinerea</i> , Say.	
95. <i>Fusus curtus</i> , Jeffr.	<i>F. Islandicus</i> , Gd. (not Ch.).
96. — <i>ventricosus</i> , Gray	Perhaps a monstrous variety of <i>F. curtus</i> .
97. — <i>pygmaeus</i> , St.	
98. — <i>decemcostatus</i> , Say.	
99. <i>Busycon canaliculatum</i> , L.	
100. — <i>carica</i> , Gmelin.	
101. <i>Fasciolaria ligata</i> , M. & A.	
102. <i>Ranella caudata</i> , Say.	
103. <i>Melampus corneus</i> , Deshayes. . .	<i>M. bidentatus</i> , Say (not Mont.).
104. <i>Psyche globulosa</i> , Rang	Oceanic.
105. <i>Loligopsis pavo</i> , Lesueur.	
106. <i>Loligo punctata</i> , De Kay.	
107. — <i>Pealei</i> , Les.	
108. <i>Spirula australis</i> , Bruguière. . .	Oceanic, and questionably indigenous.

(From Professor Verrill's papers in 'The American Journal of Science and Arts,' 1873-75, and not in the second edition of Gould's 'Invertebrata of Massachusetts'.)

109. *Pecten pustulosus*, Verrill.
110. *Stilifer Stimpsoni*, Verr.
111. *Ringicula nitida*, Verr.
112. *Pleurotomella Packardi*, Verr.
113. *Doto formosa*, Verr.
114. *Idalia modesta*, Verr.
115. *Loligo pallida*, Verr.
116. *Octopus Bairdi*, Verr. *

Additions now made by me to Dr. Mörch's list of Greenlandic Mollusca.

Species already described.

Names of Species.	Depth in fathoms and Remarks.
1. <i>Crenella faba</i> , Fabricius	1-60.
2. <i>Leda lucida</i> , Lovén	410.
3. — <i>frigida</i> , Torell	175.
4. — <i>pusio</i> , Philippi; var.	1750; North Atlantic, 1450.
5. — <i>acuminata</i> , Jeffr.	1750; N. Atlantic, 1450 and 690.

* It is no answer to say that most of the above are also southern species.

Names of Species.	Depth in fathoms and Remarks.
6. <i>Limopsis aurita</i> , Sasso	1100.
7. <i>Axinus eumyrius</i> , Sars	1100.
8. — <i>cycladius</i> , S. Wood	1750.
9. <i>Tellina inflata</i> , Stimpson	60.
10. <i>Dentalium striolatum</i> , St.	410 and 1750.
11. <i>Siphonodentalium Lofotense</i> , Sars.	1750.
12. <i>Chiton ruber</i> , Pennant	12. Not <i>C. ruber</i> of Linné.
13. <i>Trochus umbilicatus</i> , Broderip and Sowerby.	20. Not a variety of <i>T. Gronlandicus</i> .
14. <i>Rissoa arenaria</i> , Mighels and Adams.	5-35.
15. <i>Eulima stenostoma</i> , Jeffreys	410.
16. <i>Pilidium radiatum</i> , Sars	12 and 60.
17. <i>Aporrhais Serresiana</i> , Michaud	410. Fragments. Not <i>A. occidentalis</i> .
18. <i>Trophon truncatus</i> , Ström	12-60 fms.
19. <i>Fusus fenestratus</i> , Turton	410.
20. <i>Pleurotoma declivis</i> , Lov.	60.
21. <i>Spirialis retroversus</i> , Fleming	1750. Oceanic, and having sunk (with <i>Globigerinæ</i>) to the bottom.

Species undescribed*.

22. <i>Atretia gnomon</i> , Jeffr.	1100. See below.
23. <i>Pecten fragilis</i> , Jeffr.	1750.
24. <i>Lima gibba</i> , Jeffr.	1750.
25. <i>Nucula reticulata</i> , Jeffr.	1100. Also 'Porcupine' Expedition, 1869.
26. — <i>expansa</i> , Jeffr.	1750. Also Porc. Exp., 1869.
27. <i>Glomus nitens</i> , Jeffr.	1750. Also Porc. Exp., 1869.
28. <i>Malletia cuneata</i> , Jeffr.	1750. Also Porc. Exp., 1869 and 1870.
29. <i>Kellia symmetros</i> , Jeffr.	1750.
30. <i>Axinus incrassatus</i> , Jeffr.	1750.
31. <i>Dentalium candidum</i> , Jeffr.	1100. Also Porc. and 'Challenger' Expeditions.
32. <i>Pleurotoma rubescens</i> , Jeffr.	10.
33. <i>Utriculus substriatus</i> , Jeffr.	1750. Fragments.

ATRETIA†, Jeffreys.

Nothing could be observed as to the animal, except that a few delicate bristles (which were persistent or fixed) protruded beyond the edges of the valves in an adult as well as a young specimen. The larger specimen was partly covered with small sessile Foraminifera (*Truncatulina lobatula*)

* Some of these species have been elsewhere noticed, and will be described before the Report is published.

† From *ἀτρητος*, imperforate.

and some young of this remarkable Brachiopod. Byssus long, tubular, and flexible, attached to a fragment of the case of a tubular Foraminifer.

SHELL inequivalve, triangular, imperforate, of a fibrous texture: *beak* prominent and pointed, but not incurved: *byssal foramen* elongated: *hinge-line* narrow: *skeleton* composed of two funnel-shaped processes, which diverge from the beak in the upper or larger valve, and of two blade-like processes, besides an upright plate (like the hand or index of a sundial) in the upper part of the lower or smaller valve.

Its nearest ally is *Rhynchonella*, from which it appears to be distinguishable only by the straight instead of incurved beak, and by the arms or brachial cirri not being coiled.

I know of one species only, which I propose to name *gnomon*. It has been figured by Mr. Davidson in the publications of the Palæontographical Society for 1874, pl. i. f. 7-10.

'Valorous' Expedition, 1100-1750 fms.; 'Porcupine' Expedition, 1869, 1380-1443 fms.

GLOMUS*, Jeffr.

SHELL nearly spherical: *cartilage* internal, elongated: *teeth* numerous, minute, and set obliquely.

Has the aspect of *Pectunculus* and the hinge of *Leda*; but the teeth are not arranged as in either of those genera. One species only is known to me, which I have named *nitens*; it is minute, about $\frac{1}{10}$ of an inch. It occurred in Davis Strait, 1750 fms.; also 'Porcupine' Expedition, 1869, on the west coast of Ireland, 1180-1476 fms., and North Sea, 557 fms.

SEGUENZIA†, Jeffr.

SHELL globular or conical, glossy, without epidermis, exquisitely sculptured; upper part of the last whorl deeply and widely grooved: *pillar* abruptly notched below, and exhibiting a small tooth-like process: *base* either deeply umbilicated or imperforate.

This genus evidently belongs to the *Solarium* family, and is allied to that subgenus or section of the genus *Solarium* which the late Dr. J. E. Gray named *Philippia*, and founded on the *Trochus hybridus* of Linné. *Seguenzia* differs, however, from *Solarium* and from every other genus of that family in the last whorl having a deep and wide groove, which is placed in the upper part, instead of a narrow slit placed in the middle or periphery as in *Scissurella* and *Pleurotomaria*; nor is the mouth of the shell entire as in those two genera. Three species are known to me, viz. :—

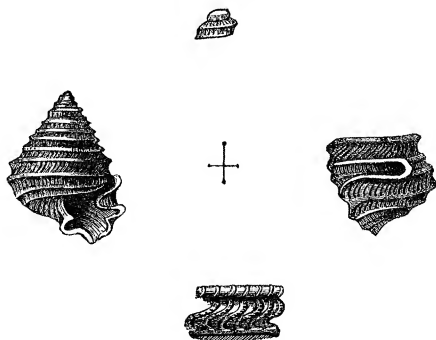
1. *S. formosa*, sp. n. Base imperforate. 'Valorous' Expedition, North Atlantic, 1450 fms. 'Porcupine' Expedition, Bay of Biscay, off

* A ball of thread.

† Dedicated to Professor G. Seguenza, the distinguished Palæontologist at Messina.

the coasts of Spain and Portugal, 718–795 fms. 'Challenger' Expedition, Station 56, S.W. of Bermudas, 1075 fms. Gulf of Mexico, 325 fms. (Pourtales). Fossil at Trapani in Sicily (Seguenza). Prof. Seguenza referred this species to the genus *Trochocochlea* of Klein; but the type of that subgenus of *Trochus* is *Trochus lineatus* of Da Costa, which has no relation to the present genus.

The accompanying figures of a perfect specimen from the 'Valorous' dredgings will serve to show the beauty of this species and the peculiarity of the genus.



Seguenzia formosa, Jeffr.

2. *S. elegans*, sp. n. Base perforated or umbilicated. Porc. Exp. 1870, off the coast of Portugal, 740–1095 fms.
3. *S. carinata*, sp. n. Base widely and deeply umbilicated. 'Valorous' Exp., North Atlantic, 690 fms.; Porc. Exp. 1870, Bay of Biscay, off the coasts of Spain and Portugal, 718–1095 fms. 'Challenger' Expedition, west of Fayal, Azores, 1000 fms.

Note on the Odontophore of *Buccinum Greenlandicum*.

By JABEZ HOGG, F.L.S.

The odontophore of *B. Greenlandicum* differs from that of *B. undatum* both in the lateral and central teeth. In *B. Greenlandicum* the lateral portion of the ribbon contains about sixty rows of bold translucent teeth, arranged in series of three set on the same shaft; the superior of which is recurved and much prolonged, while the central one is small and subdued, and the third or last is of medium size and slightly recurved. The median (rachidian) portion of the ribbon bears upon its more central part a series of symmetrically arranged rows of four teeth, all of which are of the same length, short and more suppressed than the smaller of the laterals, but far more developed than those of *B. undatum*.

I have noticed, in my former examinations of the odontophores of *Buccina*, that in the early condition (embryonic state) there are three

centres of silication, and that the ribbons when fully developed are enclosed in a kind of muscular and membranous sheath. This sheath can be stripped off and allow of an easy separation of the three bands.

In *B. undatum* the odontophore is said to be longer than the whole length of the body of the animal. This I should think is a mistake; at all events that of *B. Groenlandicum*, when stretched out, is somewhat less than half the length of the body.

CRUSTACEA, TUNICATA, POLYZOA, ECHINODERMATA, ACTINOZOA, FORAMINIFERA, POLYCYSTINA, and SPONGIDA. By the Rev. A. M. NORMAN, M.A.

Four hundred and seven Invertebrata brought home by H.M.S. 'Valorous,' and belonging to the above classes have been examined. Considering the very short time allowed for dredging, the state of the weather, and other circumstances, the results of the Expedition are surprising and reflect great credit on all concerned. Moreover, if a proof were needed, it is here found how little is yet known of the fauna of the deep waters within the Arctic Circle, or even of the inhabitants of the shallower parts of these northern seas. It is necessary to bear in mind that the investigations of the 'Valorous' were chiefly confined to those portions of the coast which had been previously most carefully worked by the Scandinavian naturalists. Each time that the dredge was let down in the deeper parts of Davis Strait, it brought up animals of high interest altogether new to science; and it is not a little remarkable that among these were representatives of genera which had until lately been regarded as exclusively confined to tropical or subtropical seas. The results of this Expedition show how desirable it is that really systematic dredging should be carried out in Davis Strait, and still more that the wholly unexamined fauna of Baffin's Bay and Smith's Sound should be investigated. It is to be hoped that the Arctic Expedition may be enabled to carry out successful researches with respect to the fauna of these high latitudes. The determination of the character of the animals living in the abyss of the Arctic seas is a matter of no small importance whether regarded from a zoological or from a geological standpoint.

Of the 407 species, 339 were procured in Davis Strait, and 128 in the North Atlantic, many animals, especially among the Foraminifera, having been brought home from both areas.

I have made a careful examination of all that has been written on the animals belonging to those classes on which it is my duty to report which had been brought by previous British Arctic expeditions from Davis Strait, and I find that the total aggregate of these Invertebrata of earlier expeditions is at the most 166 species as against 339 brought home by the 'Valorous,'—a convincing proof of the results which can be obtained by the use of modern appliances when in skilful hands.

Of the 113 Greenland Crustacea, 43 are known as North-American,

82 as European, 49 as British ; but one only, the Amphipod *Anonyx gulosus*, Kröyer, has as yet been found living in the Mediterranean.

Of the 66 Polyzoa, 33 are American, 59 European, 35 British, 1 Mediterranean. This Polyzoan is *Lepralia hyalina*, the range of which seems to be cosmopolitan.

Of the 30 Echinodermata, 27 are American, 21 European, and 9 British, but not any Mediterranean.

Of the 103 Foraminifera, 46 are known as American, 54 as European, 52 as British, and many Mediterranean.

Taking these four classes together, therefore, we find that of 312 Greenland species, 149 (or 47 per cent.) are North-American, 216 (or 69 per cent.) are European (including Spitzbergen under that term), and 145 (or 46 per cent.) are British. We might thus be led to infer that the Greenland Marine Invertebrata approached much more nearly in character to the European than to the American fauna. Closer examination, however, of the facts seems to prove that such a conclusion would be erroneous ; for while the Marine Invertebrata of Europe have been very carefully worked out, very much remains to be done among all the less conspicuous animals of the North-American coasts*. Thus, as regards the great class of the Crustacea, comparatively little is known of any orders except those which contain the large stalk-eyed forms.

If, then, disregarding all other classes and orders, we confine our percentages to the Echinodermata and Stalk-eyed Crustacea, which we know to have been well worked up on the North-American coast, we find the results altogether changed ; for of the 30 Greenland Echinodermata 27 (or 90 per cent.) are American, 21 (or 70 per cent.) are European, and 9 (or 30 per cent.) are British ; and of the 15 Stalk-eyed Crustacea, 13 (or 86 per cent.) are American, 11 (or 73 per cent.) are European, and 6 (or 40 per cent.) are British ; and we cannot but conclude that when the American marine fauna shall have been as fully known as that of European seas, the fauna of Davis Strait will be found to possess an American rather than a European character, though the contrary might at first sight be inferred from our present unequal knowledge of the several faunæ.

The following Tables will show at a glance :—(1st) the number of animals belonging to the several classes, (2nd) to the orders of the *Crustacea*, *Polyzoa*, and *Echinodermata*, which have been dredged by the 'Valorous,' whether in Davis Strait or the North Atlantic, and the proportionate geographical range of the forms in the American, European, and British seas ; 3rd, our knowledge of the fauna of Davis Strait previous to the 'Valorous' Expedition, and the increased knowledge which is the fruit of that expedition.

* The more the fauna of the western side of the North Atlantic is studied the nearer it is found to approximate to that of the western side. This has become very evident from the recent valuable operations carried on, under the conduct of Messrs. Verrill and Smith, by the American Government, and, under Mr. Whiteaves in the Gulf of St. Lawrence, by the Canadian Government.

TABLE I.—Summary of the Crustacea, Tunicata, Polyzoa, Echinodermata, Actinozoa, Foraminifera, Polycystina, and Spongida, showing geographical distribution and other particulars.

	GREENLAND.					Brought by 'Valorous' from North Atlantic.	Total species brought home by 'Valorous.'
	Greenland and Davis Strait, 'Valorous.'	Known as N.-American.	Known as European.	Known as British.	Total number of species brought home by other British Arctic Expeditions.		
	1.	2.	3.	4.	5.	6.	7.
CRUSTACEA	113	43	82	49	72	29	133
TUNICATA.....	7	...	...	...	6	...	7
POLYZOA	66	33	59	35	12	2	67
ECHINODERMATA	30	27	21	9	22	5	35
ACTINOZOA	7	2	2	2	...	...	7
FORAMINIFERA.....	103	46	69	65	54	83	142
POLYCYSTINA	8	...	...	...	...	...	8
SPONGIDA	5	1	1	1	...	3	8
Total	339	152	234	161	166*	122	407

TABLE II.—The Crustacea, Polyzoa, and Echinodermata divided into their several orders (the columns corresponding to those in Table I.).

	1.	2.	3.	4.	5.	6.	7.
CRUSTACEA.							
Brachyura	3	3	2	2	1	1	4
Anomura	1	1	1	1	1	...	1
Macrura	11	9	8	2	7	1	12
Stomapoda	...	...	...	...	1	...	...
Cumacea	6	...	2	1	2	1	7
Isopoda	7	1	2	1	3	4	9
Amphipoda	39	12	32	9	18	6	42
Phyllopoda	3	1	2	2	1	...	3
Ostracoda	34	12	27	26	25	15	45
Copepoda	2	0	1	1	6	many	2
Cirripedia	4	3	4	3	2	1	5
Pycnogonoidea	3	1	1	1	5	...	3
	113	43	82	49	72	29	133

* This summary includes the animals collected in Parry's first and third voyages, Ross's second voyage, Penny's, Belcher's, and M'Clintock's voyages; and the Polyzoa recorded by Busk, the Ostracoda by Mr. G. Brady, and the Foraminifera by Parker and Jones.

TABLE II. (*continued*).

	1.	2.	3.	4.	5.	6.	7.
POLYZOA.							
Cyclostomata.....	10	8	10	8	2	...	10
Ctenostomata	1	1	1	1	...	...	1
Chilostomata.....	55	24	48	26	10	2	56
	66	33	59	35	12	2	67
ECHINODERMATA.							
Holothuroidea	8	7	4	1	3	1	9
Echinoidea	3	2	2	2	1	1	4
Asteroidea.....	8	8	7	3	5	2	10
Ophiuroidea	10	9	8	3	12(?)	1	11
Crinoidea	1	1	?	...	1	...	1
	30	27	21	9	22	5	35

TABLE III.—Showing the total Fauna of Davis Strait as known from *all* sources previously to the 'Valorous' Expedition, and the additions made to it by that Expedition.

	W. Greenland Fauna as known in 1875.	Results of 'Valorous' Expedition in 1875.	Addition to Fauna in 1875.	W. Greenland Fauna as now known.
CRUSTACEA	214	113	35	249
TUNICATA.....	14	7	...	14
POLYZOA	78	66	16	94
ECHINODERMATA	34	30	2	36
ACTINOZOA	8	7	2	10
FORAMINIFERA.....	54	103	63	117
POLYCYSTINA	0	8	8	8
SPONGIDA.....	28	5	...	28
	430	339	126	556

It will be seen from the above that an important addition has been made to the Greenland fauna. The numbers must be regarded as approximate only, since there is still some material to be worked through.

In the following notes, the more remarkable animals in the several dredgings are briefly noticed.

Tow-net.

In the tow-net in Lat. $52^{\circ} 33' N.$, Long. $26^{\circ} 44' W.$, in the North Atlantic, the very rare *Pasiphaea tarda*, Kröyer, was taken. The same mode of collecting also produced *Nautilograpsus pelagicus*, Roux, *Idotea robusta*, Kröyer, *Themisto libellula* (Mandt), *Parathemisto compressa* (Goës), and *Tauria medusarum* (Kröyer), together with many Copepoda, a Campanularian, *Lepralia hyalina*, many Diatomacea, &c. In Davis Strait were similarly taken *Themisto libellula* (Mandt), *Themisto bispinosa*, Boeck, *Tauria medusarum* (Kröyer), and *Onesimus littoralis* (Kröyer), together with the beautifully spinose Copepod recently figured by Buchholz, in the Report of the German North-Pole Expedition, under the name "*Cleta minuticornis*, Müller"*. It is, however, most certainly not the species described by Müller or Baird; and I would therefore propose for this very distinct Arctic form the name *Cleta horrida*.

Holsteinborg Harbour, 7-35 fathoms.

Holsteinborg Harbour produced a rich harvest of Arctic forms. The Crustacea included the great spider crab of the Greenland seas, *Chionectes opilio* (Fabr.), the fine northern shrimps *Crangon boreas* (Phipps) and *Argis Lar* (Owen), the rare Amphipods *Onchomene minuta* (Kröyer), *Byblis Gaimardi* (Kröyer), *Ædiceros lynceus*, M. Sars, and *borealis*, A. Boeck, *Protogeneia inermis* (Kröyer), *Antonoe macronyx*, Bruzelius, and *Photis Reinhardtii*, Kröyer, together with many species familiar to us off the British coasts. The Ostracode *Bradycinetus Brenda* (Baird) was in extraordinary abundance, along with *Cytheridea papillosa*, Bosquet, *Sclerochilus contortus* (Norman), *Xestoleberis depressa*, G. O. Sars, *Cytherura undata*, Sars, *Cythere tuberculata*, *emarginata*, *lutea*, and other species. Most of the specially Greenlandic Echinodermata occurred here. The Holothurians *Orcula Barthii*, Trosch. (? or new), *Cucumaria minuta*, Fabr., and *calcigera*, Agassiz, *Psolus Fabricii*, Düb. and Koren, *Chirodota læve*, Fabr., and *Myriotrochus Rinkii*, Steenstrup, the Ophiuridan *Ophioglypha nodosa*, Lütken, and the Asteridan *Asterias albula*, Stimpson, were associated with forms which are also European. Here, too, were such interesting Polyzoa as:—*Leieschara subgracile* (D'Orb.); *Celleporaria in-crassata*, Lamk.; *Bugula Murrayana*, Bean, both the typical form and that named by Packard from the coast of Labrador (*B. fruticosa*) and by Lovén from Finmark (*B. quadridentata*). Our common *Lepralia ventricosa*, Hassall, seems to be also the most abundant Greenland Lepralian; it was found here and in all the other inshore dredgings. A new *Cellepora* in Holsteinborg Harbour and other Greenland localities had been previously sent to me by Mr. Whiteaves from the River St. Lawrence, where it was procured in the dredgings of the

* Die zweite deutsche Nordpolarfahrt in den Jahren 1869 und 1870, p. 393, pl. xv. fig. 3.

Canadian Government; it may fitly bear the name of that naturalist, *Cellepora Whiteavesi*. The Shetland *Membranipora sacculata*, Norman, furnished here another link between our fauna and that of the Greenland seas. The more remarkable Foraminifera in the locality were *Trochammina gordialis*, Parker and Jones, *Lituola Canariensis*, D'Orb., *Textularia biformis*, Parker and Jones, and *Bolivina punctata*, D'Orb.

Godhavn Harbour, Disco, 5-20 fathoms.

There are certain common British Invertebrata which are equally abundant on the Greenland coast. These animals are for the most part also circumpolar in their distribution; conspicuous amongst these are *Hyas aranea* (Linn.) and *coarctata*, Leach (of gigantic size), *Eupagurus pubescens* (Kröyer), *Solaster papposus* (Linn.), *Ophiopholis aculeata* (Müll.). With these in Godhavn Harbour were associated *Chioneceetes opilio* (Fabr.), *Argis Lar* (Owen), *Hippolyte Fabricii*, Kröyer, and *turgida*, Kröyer, *Ampelisca Eschrichtii*, Kr., and *Haploops tubicola*, Lilljeborg, these two Amphipods being in great abundance. Among many Ostracoda were the rare *Cythere borealis*, G. S. Brady, *canadensis*, G. S. Brady, and an undescribed species of the same genus; and *Cytherura granulata*, G. S. Brady, and *cristata*, G. S. Brady, the two latter species being only previously known as fossil in the Posttertiary deposits of Canada. The great sea-cucumber, *Cucumaria frondosa* (Gunn), was living in company with *C. calcigera*, Agas., *Chirodota læve* (Fabr.), *Asterias albula*, Stimpson, *Ophiacantha bidentata* (Retz.), and *Ophioglypha robusta* (Ayr). Of the Polyzoa may be named:—*Scrupocellaria scabra*, var. *elongata*, Smitt; *Bugula Murrayana*, var. *fruticosa*, Packard; *Lepralia cruenta*, *sinuata*, *ansata*, *acutirostris*; *Cellepora plicata*, Smitt; and *Hippothoa divaricata*, Lamx.,—the true form, and not my *H. expansa*, which is much more abundant in the Arctic seas, and has probably been frequently recorded under the former name. Among thirty-six Foraminifera identified from this locality are *Dentalina consobrina*, D'Orb. (or the form figured under this name by Parker and Jones), *Polymorphina Burdigalensis*, D'Orb., *Pullenia sphaeroides*, D'Orb., *Verneuilina polystropha*, Reuss, *Cassidulina obtusa*, D'Orb., *Pulvinulina Karsteni*, Reuss, and *Discorbina obtusa*, D'Orb.

A small quantity of material examined from the harbour consists of a ferruginous mud, which contained large quantities of the tubes of *Pectinaria* and of another more delicate Annelid. The Foraminifera among this mud were specially interesting, as exhibiting a marked parallelism with those recorded by Mr. G. M. Dawson from Gaspé Bay in the Gulf of St. Lawrence*. Of the twenty-eight Lively-Bay species, twenty-two are also in Mr. Dawson's Gaspé-Bay list; and

* On Foraminifera from the Gulf of St. Lawrence, by G. M. Dawson ('Canadian Naturalist,' 1870).

these include two very marked forms not hitherto found in any other localities, namely *Rhabdopleura abyssorum*, Parker, and *Lituola cassis*, Parker, and also *Nonionina Labradorica*, Parker, and *Bulimina pyrula*, D'Orb. The Ostracoda include *Cythere tuberculata*, G. O. Sars, *C. Canadensis*, G. S. Brady, and *Paradoxostoma flexuosum*, G. S. Brady; the last of gigantic size as compared with the dimensions it attains in our own seas.

Station No. 1. Off Hare Island, Waigat Strait, at the entrance of Baffin Bay; 175 fathoms.

The chief features in the dredging were the magnificent *Astrophytons* of the two Arctic species *Agassizii*, Stimpson, and *eucnemis*, Müll. & Trosch., and the abundance of luxuriantly developed *Hornera lichenoides*, upon the branches of which were living many other very rare Polyzoa. *Hippomedon abyssi* (Goës), *Pontoporeia femorata*, Kröyer, and *Amphithopsis latipes* (M. Sars) among the Amphipoda, *Pallene intermedia*, Kröyer, *Nymphon grossipes*, Fabr., and *N. hirtipes*, Bell, among the Pycnogonoidea, were the most interesting Crustacea. *Ctenodiscus crispatus*, Retz., was abundant; and the only example of *Antedon Eschrichtii*, Müll. & Trosch., taken in the expedition occurred here. The Polyzoa were many and good; for example, *Eschara elegantula*, D'Orb., *Leieschara subgracile* (D'Orb.), *Idmonea Atlantica*, Forbes, *Alecto diastoporides*, Norman, *Menipea arctica*, Busk, and *Discopora sincera*, Smitt.

Station No. 3. Lat. 69° 31' N., Long. 56° 1' W.; 100 fathoms.

Among the Crustacea here were the extraordinary Isopod *Munnopsis typica*, M. Sars (which that excellent naturalist elaborately described in the last work published before his lamented death*), *Glaucneme leucopis*, Kröyer, *Hippomedon abyssi* (Goës), and *Aceros phyllonyx* (M. Sars). Among the Polyzoa *Flustra membranaceo-truncata*, Smitt, and a new *Lepralia*, which in many respects comes near *L. trispinosa*, but which, in addition to the acute-mandibled avicularia, has very numerous ovoid avicularia with rounded mandible scattered over the cells, while the mouth wants the spout-like projection of the lower margin, and is somewhat different in outline: this form may be named *L. Jeffreysi*. Among the Echinodermata were *Myriotrochus Rinkii*, Steenstrup, *Asterias Grœnlandica*, Stimpson, *Ophioglypha Sarsii*, Lütken, *Ophiocten sericeum* (Forbes), *Amphiura Sundevalli*, Müll. & Trosch., and *Astrophyton eucnemis*, Müll. & Trosch. The Arctic Actinian *Chondactinia nodosa* (Fabr.) was also procured here, together with an undescribed *Ammothoa*, which Dr. Lütken has kindly given me the means of comparing and identifying with his *Ammothoa arctica*, Lütken, MS.

* Bidrag til kundskaab om Christiania-Ejordens Fauna, 1868, pls. vi. & vii. pp. 70-95.

Station No. 4. Lat. 67° 50' N., Long. 55° 27' W.; 20 fathoms.

Rare Crustacea were met with here which had not been found in the preceding localities:—*Hippolyte spinus*, Leach, *aculeata*, Kröyer, and *Phippsii*, Kröyer; *Socarnes VahlII* (Rhdt.); *Anonyx lagena* (Rhdt.), and *gulosus*, Kröyer; *Onesimus plautus* (Kröyer); *Vertumnus serratus* (O. Fabr.); *Amphithoe carinata*, Kröyer; *Elliceros saginatus*, Kröyer; *Podocerus anguipes*, Kröyer; *Caprella septentrionalis*, Kröyer; *Cythere Finmarchica*, G. O. Sars, and *angulata*, G. O. Sars; *Cytheropteron latissimum* (Norman), and *pyramidale*, G. S. Brady; and *Cytherura clathrata*, G. O. Sars; and the only example procured of the circumpolar *Solaster endeca* (Lin.) and of *Pteraster militaris* (Müller) were from this locality.

Station No. 5. Lat. 66° 59' N., Long. 55° 27' W.; 57 fathoms.

A wonderfully rich dredging. Bottom sand and shells, with an immense profusion of *Rhynchonella psittacea*, Ch. (living and dead, the latter covered with Polyzoa), *Balanus porcatus*, Da Costa, *Cynthia rustica*, L., and *Alcyonidium gelatinosum*, L. Among these animals Crustacea were living in extraordinary numbers, which included almost the whole of the Arctic Palæmonidæ and Crangonidæ, namely, *Crangon boreas* (Phipps), *Hippolyte Gaimardi*, M.-Edw., *gibba*, Kröyer, *borealis*, Owen, and *aculeata*, Kröyer; the Cumacea, *Diastylis Edwardsii* (Kröyer), *D. Rathkii* (Kröyer), and *Campylaspis rubicunda* (Lilljeborg); the Amphipoda, *Vertumnus inflatus* (Kröyer), *Stegocephalus ampulla* (Phipps), *Eusirus cuspidatus*, Kröyer, *Melita dentata*, Kröyer, *Gammaropsis erythrophthalmus*, Lilljeborg; and the Entomostraca, *Nebalia bipes* (Fabr.), *Cythere dubia*, G. S. Brady, *Cytheropteron punctatum*, G. S. Brady, *Cytherideis foveolata*, G. S. Brady (only previously known in the Gulf of St. Lawrence), and *Polycopse orbicularis*, G. O. Sars. On *Hippolyte spinus*, Sow., there was the parasitic Isopod *Bopyrus abdominalis*, Kröyer; and on the abdomen of *Hippolyte borealis*, Kr., the parasitic Cirriped *Sylon Hippolytes*, Kr. Altogether there were no less than fifty species of Crustacea in this dredging. It was also very rich in Polyzoa, among which were:—*Escharoides rosacea* (Busk), and *Sarsii*, Smitt; *Leieschara subgracile* (D'Orb.), and *crustaceum*, Smitt; *Eschara elegantula*, D'Orb.; *Lepralia crystallina*, Norman, *labiata*, Busk, *bellis*, Busk, *hippopus*, Smitt, *spathulifera*, Smitt, and many others; *Hippothoa expansa*, Norman; and luxuriant growths of *Celleporaria incrassata*, D'Orb. The Echinodermata included *Asterias polaris*, Müll. & Trosch., *Ophiacantha bidendata* (Retz.), and *Ophioglypha robusta*, Ayr. Of thirty-five Foraminifera, ten belonged to the genus *Lagena*, rarest among which was the Greenlandic *L. striato-punctata*, Parker and Jones; there were also *Lituola globigeriniformis*, Parker and Jones, *Cyclammina cancellata*, H. B. Brady, MS., and *Bulimina elegantissima*, D'Orb.

Station No. 6. Lat. 64° 5' N., Long. 56° 47' W.; 410 fathoms.

Only a very small quantity came up in the dredge; but every scrap was a treasure, and showed that we as yet knew nothing whatever of the rich fauna which lies hid in the depths of the sea in the Arctic regions. Two actinozoans of the highest interest occurred here. Of these the first is a remarkably fine Gorgonian belonging to the genus *Mopsea*. It differs entirely from the recently described *Mopsea borealis*, M. Sars*, the only previously known northern form, and approaches much more nearly to the character of species from tropical seas. It grows in the form of a thick little bush, 6 inches high (probably, at least, 9 inches when perfect). The main stem continuously divides with verticils of three or four branches each, and the branches thus formed similarly subdivide. The polyps, instead of being short as is the case in *Mopsea borealis*, are very long, longer even than in *Mopsea Mediterranea*, Risso†. The form may be named *Mopsea arbuscula*. In floating the sharp sand of this dredging to separate the Foraminifera and Ostracoda, a tip of a branch of *Antipathes arctica*, Lütken, was procured. Although this fragment was not more than a quarter of an inch long, there can be no doubt of its belonging to the species described by Dr. Lütken‡; and we thus obtain a habitat for this Arctic form of what is otherwise known only as a marked tropical genus, if we except an as yet undescribed species found in the 'Porcupine' Expedition of 1869. The type and only known specimen of *Antipathes arctica*, described by Dr. Lütken, was found in the stomach of a shark (*Scymnus microcephalus*), in Rodebay, about two miles north of Jakobshavn in Greenland, by M. K. Fleischer. The Spatangoid *Schizaster fragilis* (Düb. and Kor.) was also dredged here, and is an addition to the Greenland fauna, to which it is remarkable that no Spatangoid and only one Echinoid, *Toxopneustes Dröbachiensis* (Müll.), was previously known to belong. The few Foraminifera did not include any species worth special notice; but among the Ostracoda were *Cytheridea Sorbyana*, Jones, and *Cythere abyssicola*, G. O. Sars.

Station No. 7.

Nothing received from this station.

Station No. 8. Lat. 62° 6' N., Long. 55° 56' W.; 1350 fathoms.

The very small quantity of sand from the sounding of this station contained, among many more common Foraminifera, a Nodosarian which incorporates sand and extraneous matter in its shell-substance, and appears

* On some remarkable Forms of Animal Life from the Great Deep of the Norwegian Coasts (Christiania, 1872), pp. 50-57, pl. v. figs. 1-23.

† Hist. Nat. des principales productions de l'Europe Méridionale, vol. v. p. 332, pl. viii. figs. 43, 44.

‡ Oversigt over det Kongl. Danske Vidensk. Selsk. Forhandl. 1871 (translated Ann. & Mag. Nat. Hist. 1872, ser. 4, vol. x. p. 77).

to be the same as the Tertiary fossil figured by Schlicht from Pietzpuhl* (pl. vi. figs. 29-32), and which has been named by Reuss *Nodosaria Schlichtii*; this sand-incorporating form seems common in the depths of the North Atlantic, as I have observed it not only in many of the 'Valorous' dredgings, but also in several of those of the 'Porcupine,' 1869. *Orbitolites tenuissimus*, Carpenter†, *Pullenia quinqueloba*, Reuss, and *Lituola nautiloidea*, Lamk., also occurred here; the *Orbitolites* seems to have a wide distribution in the deep sea, as I have just received specimens from the Marquis da Monterosato which he dredged in 100-200 fathoms off the Sicilian coast.

Station No. 9. Lat. 59° 10' N., Long. 50° 25' W.; 1750 fathoms.

This was the last deep-water dredging in Davis Strait. A remarkable new genus of Echinoidea occurred here. In general outline it is almost cylindrical, the length being to the breadth as 5 to 2; and the height, which is greatest in the centre, exceeds the breadth. Viewed laterally the cylindrical form is interrupted anteally by two fifths of the length of the animal being sloped away anteriorly above. This sloped-away portion of the Spatangoid is surrounded by a well-marked fasciole, containing within it the ambulacral system, which is thus excentric and confined to the anterior portion of the animal; the four lateral ambulacra are remarkably short, consisting of only four or five pairs of pores each: the anterior odd ambulacrum is much larger, and consists of nine pairs of pores, which are of much larger size than those of the lateral ambulacra; it is situated in a broad but very shallow depression. The tentacles of the upper portion of the odd ambulacrum are very large and remarkable, of umbrella-like form, supported on flexible columns, which are densely studded and strengthened with fusiform nodulous spicula. The spines are of two forms, battledoor-shaped and of the more usual form. Pedicellariæ of two if not of three kinds. Mouth inferior, at one third the length of the animal from the anterior extremity, not situated in a groove (as is the case in *Pourtalesia*). Anal aperture dorsal, at about one fourth the length of the animal from the posterior extremity, nearly flush with the surface, neither in a deep depression (as in *Pourtalesia*) nor in an anal groove.

In its elongated form this genus shows an approach to *Pourtalesia*, but in mouth, anal aperture, and the condition of the ambulacral system it is altogether different. The nearest approach I know to the general outline of this genus is found in the Chalk fossil *Archiacia sandalina*, Ag.; but in *Archiacia* the anal aperture is inferior. Indeed the conditions of this organ are altogether exceptional; for in those known genera

* 'Die Foraminiferen des Septarienthones von Pietzpuhl,' 1870, pl. vi. figs. 29-32. Reuss, Sitzb. d. k. Akad. d. Wissensch. I. Abth. Nov.-Heft, 1870, 'Die Foraminiferen des Septarienthones von Pietzpuhl' (separate copy, p. 18).

† Thomson's 'Depths of the Sea,' woodcut, p. 91.

in which it assumes a dorsal position (e.g. *Cassidulus*, *Echinobrissus*, *Clypeopagus*, and other genera) it is always sunk in an anal groove. This new and most interesting form will be named *Ærope rostrata* by Sir Wyville Thomson*. In this dredging were also procured a specimen of *Leucon longirostris*, G. O. Sars† (which was described by him from a fragment procured in the 'Josephine' Expedition), *Leucon serratus*, Norman, a new *Diastylis* (*D. armata*), and five undescribed Isopoda. This dredging was also by far the most important as regards the Foraminifera. The *Globigerinae* here presented an entirely different aspect from that of those usually met with—so much so that they might have been taken to belong to a different species; the segments have a comparatively compactly compressed appearance, very different from the rounded, swollen outline so characteristic usually of the chambers of *Globigerina bulloides*. The ooze, moreover, has a reddish tinge, and contains a large number of remarkable arenaceous Foraminifera, and more Polycystina than are usually met with in North-Atlantic dredgings. From the peculiar appearance of the *Globigerinae* and the character altogether of this dredging, it would seem that we have here the commencement of that transition state of the sea-bed between the '*Globigerina*-ooze' and the 'Red Clay‡' which has been termed by Sir Wyville Thomson "Grey ooze," and has been found by the 'Challenger' Expedition to constitute the bottom at depths of about 2500 fathoms in the South Atlantic. I am thus led to infer that the peculiar form of the *Globigerinae* is dependent partially or wholly upon incipient decomposition. The arenaceous Foraminifera are an extraordinary assemblage. They embrace no less than eighteen distinct and well-marked forms, most of the more conspicuous species found in the 'Porcupine' Expedition, viz. *Rhabdammina*, *Pilulina*, what Carpenter has called 'nodosarine,' 'moniliform,' 'nodosarine No. 2,' 'globigerine,' 'orbuline,' and 'orthocerine' *Lituola* §, and other forms. With these there are others which have not been before observed, one of which must not be passed without notice. The genus *Astrorhiza* was constituted by Sandahl|| for the reception of a large flat disk-like Rhizopod, having a test which consists of extraneous matter

* When this description was read I had suggested a name for the present species; but having since learnt from Sir Wyville Thomson that it has also been procured in the 'Challenger' Expedition, I gladly adopt the above name, under which I found that he was about to describe it.

† Beskrivelse af de paa Fregatten Josephines Expedition funde Cumaceer, 1871, p. 42, pl. xv. fig. 75.

‡ Proc. Roy. Soc. 1874, vol. xxiii. p. 39 *et seq.*

§ See Carpenter, 'The Microscope,' 5th edit. 1875, pp. 531–535, and woodcuts.

|| Öfversigt af Kong. Vet. Akad. Förhand. 1857, p. 301, pl. iii. fig. 526. The same species has since been described by Bessels, *Jenaische Zeits. für Naturwiss.*, heraus. von der med.-natur. Gesellschaft zu Jena, 1857, p. 265, pl. xiv., under the name *Haeckelina gigantea*; and by Schultze, 'Jahresbericht der Commission zur wissenschaft. Untersuchung der deutschen Meere in Kiel für 1872–73,' pl. ii. fig. 10, under the name *Astrodiscus arenaceus*.

(pieces of shell, sand, and other materials) roughly cemented together, apparently without any selective power being exercised in the choice of the materials. From the edge of the disk proceed numerous spoke-like radii, giving the whole animal a stellate appearance; pseudopodia are extruded from the end of these radii; and Bessels has shown that in its most perfect state a number of these disks are attached to each other by their radii, so as to form a flat network animal, of which each disk will represent a chamber. This remarkable animal, which I have frequently taken off the British coast, was called by Sandahl *Astrorhiza limicola*. In the 'Porcupine' Expedition of 1869 a Rhizopod was dredged between Shetland and Färöe which had a much less regular outline, being sometimes stellate and sometimes cervicorn, and the test was composed entirely of fine sand-grains cemented together; to this Dr. Carpenter has given the MS. name *Astrorhiza arenaria**. At station No. 8 a beautiful form was found which must also be referred to this genus; the chambers are more or less ovoid, not flattened as in the previously known forms, but equally rounded on the sides and above and below; the spoke-like pseudopodian processes, instead of being all in one plane, as in *A. limicola*, radiate in all directions. Several specimens occurred in which two chambers were united together, a fresh chamber being developed at the end of one of the radiating processes; and it is probable that in its most perfect state the animal would consist not only of a series of chambers extended on all sides, as in *A. limicola*, but of other chambers superimposed on these, so that the whole animal would be of a most complex type. The arenaceous investiture consists of fine sand-grains and sponge-spicules firmly (not loosely as in *A. arenaria*) cemented together, and is of a ruddy hue, but not ferruginous. *Astrorhiza catenata*, n. sp., may be the name to distinguish this animal. Together with several more new arenaceous forms are two calcareous Foraminifera, which though known as fossils are now for the first time met with in a living state; the one is *Cristellaria obvelata*, Reuss†, the other is one of the most beautiful species I have ever seen, and is clearly the same as the fossil described by Karrer in his 'Zur Foraminiferenfauna in Österreich,' under the name *Orbulina Neojuriniensis*, Karrer‡. I may add that one of the arenaceous forms is very near to, if not identical with, *Globigerina arenaria*, Karrer, described in the same paper.

Station No. 12. Lat. 56° 11' N., Long. 37° 41' W.; 1450 fathoms.

A bottom of *Globigerina*-ooze and pebbles. The Crustacea here met

* Since the above was written Dr. Carpenter has published a description of this species, and well illustrated its various forms, though he has not given it a specific name (Quart. Journ. Micr. Science, April 1876, p. 221, pl. xix.). It is to be hoped that Dr. Carpenter will before long give us his anxiously looked-for Report on the Foraminifera of the 'Porcupine' Expedition.

† I am indebted to Mr. H. B. Brady for the identification of this form, and for much kind assistance with respect to the Foraminifera.

‡ Sitzb. d. k. Akad. d. Wissensch. 1. Abth. April-Heft, Jahrg. 1867, pl. iii, fig. 10.

with include *Cyclaspis longicaudata*, G. O. Sars (which was described by him from the Lofoden Islands, where it was found in 150 fathoms), three new Isopoda belonging to the family *Tanaidæ*, and fourteen Ostracoda, for the most part new and very fine species, but including also *Bairdia fusca*, G. S. Brady (only known before from Australia), *Bairdia subdeltoidea*, Von Münster, and *Bairdia Crosskeiana*, G. S. Brady (described from the Levant), *Cythere scabra*, Von Münster, and *Cythere echinata*, G. O. Sars (known before from the Lofoden Islands). The Foraminifera include a fine form of the very rare *Cornuspira margaritifera*, Williamson, *Lagena pulchella*, H. B. Brady, *Nonionina pompiloides*, F. & M., *Pulvinulina pauperata*, P. & J., and *Bolivina plicata*, D'Orb. Here, too, was procured the most interesting sponge of the cruise, being a fragment of what appears to form when perfect a large cup or fan-shaped Hexactinellid, nearest allied perhaps to *Farrea occa*.

Station No. 13. Lat. 56° 1' N., Long. 34° 42' W.; 690 fathoms.

A bottom of rock and sand. Notwithstanding the difference in depth between this and the last station, out of thirteen Ostracoda found here eight are common to the two localities; and of the remaining five, four are perhaps new, and the last is the *Cythere abyssicola* of Sars. Among about fifty species of Foraminifera are two *Biloculinæ* (which do not seem referable to any of the numerous recent and fossil forms already described), a pedunculate *Planorbulina* (which was also taken in the 'Porcupine' Expedition off Färöe, but is still undescribed), together with *Cyclammina cancellata*, H. B. Brady, MS., *Rheopax scorpiurus*, Montfort, *Gaudryina pupoides*, D'Orb., and *Orbitolites tenuissimus*, Carpenter.

Station No. 14. Lat. 55° 58' N., Long. 31° 41' W.; 1230 fathoms.

Remarkable among about thirty Foraminifera are a beautiful large variety of *Uvigerina pygmæa*, D'Orb., in which the ribs are elevated into strong plicæ, and the delicate, perfectly transparent, and extremely fragile genus *Cheilostomella*, which is now for the first time recorded as occurring in a recent state. Specimens have, however, been in my collection some years, which I found among sand dredged in 1870 by Dr. Jeffreys's yacht 'The Osprey,' in 112 fathoms, off Valentia Island.

Station No. 15. Lat. 55° 58' N., Long. 28° 42' W.; 1485 fathoms.

Only a very small quantity of material examined from this locality; and it contains nothing worthy of special remark, except that a fragment of *Orbulina Neojurinensis*, Karrer, gives a second locality for that fine addition to recent Foraminifera.

Station No. 16. Lat. 55° 10' N., Long. 25° 58' W.; 1785 fathoms.

Among the *Globigerina*-ooze of this the deepest dredging of the 'Valorous' Expedition there was a mutilated specimen of an Echinoderm

belonging to the remarkable abyssal genus *Pourtalesia*. The specimen seems referable to *P. phyle*, Wyv. Thomson. Here, too, was a new Ophiuridan belonging to that section of the genus *Amphiura* which is devoid of tentacle-scales. Of this section it belongs to the subsection* which has the arm-spines simple (that is, not hatchet-formed as in *A. filiformis* and its allies); and it may be distinguished among other characters from *A. Atlantica*, Ljungman, the only other species falling into this subsection, by having only three instead of six arm-spines. The present form may be named *Amphiura abyssorum*, n. sp.

Two young Asteroidea which occurred here, although they unquestionably have not attained their mature form, have characters so distinct that we cannot refer them to any described starfish. Though differing in all details they are alike in general outline, which resembles that of our well-known *Porania pulvillus*. In one case each angle of the disk terminates in a large calcareous plate bearing a large central spine flanked on each side by smaller spines; in the other case each angle bears three spines which project upwards from the dorsal surface. In the organs of the mouth and those of the ambulacra these two Asteridans are far removed from each other. Like station No. 12, this dredging produced several undescribed Isopoda and Ostracoda; and among the Foraminifera are *Glandulina lævigata*, var. *gracilis*, Reuss, a Nodosarian which has been already referred to as apparently identical with the *Nodosaria Schlichtii*, Reuss, *Candeina nitida*, D'Orb., and *Discorbina Parisiensis*, D'Orb.

ANNELIDA.

By W. C. M'INTOSH, M.D., F.R.S.E.

The Annelida collected during this expedition were kindly placed in my hands by Dr. Gwyn Jeffreys on his return. They resembled in many respects those recently examined from the Gulf of St. Lawrence, though the series was in neither the same.

Besides the Annelids mentioned in the following list, one Nemertean is abundant. The colour is brownish purple on the dorsum, whitish beneath. The short body and large proboscis distinguish it from *Nemertes Neesii*; but it may be related to the *Amphiporus Grœnlandicus* of Örsted. The empty tubes of some of the Annelids are interesting; thus the *Globigerina*-tubes are bristled with sponge-spicules, and the latter are also used by the *Terebellæ* in forming the processes at the anterior apertures. A remarkable one occurred at a depth of 1785 fathoms, amongst the *Globigerina*-ooze (station No. 16, 'Valorous'). It consists of a slender tube (about the thickness of a stout thread) of fine greyish mud, and having at one end an enlargement. The latter is tufted with what at first sight (under a lens) appears to be minute and

* Vide Ljungman's paper on the Ophiuridans procured in the 'Josephine' Expedition, Öfversigt af K. Vet. Akad. Förhand. 1871, p. 643.

finely ramose algæ; but the microscope shows that these finely branched processes are composed of the same elements as the tube, so that the animal probably fashioned it to be in harmony with such structures. One bottle from station No. 9 contained about twenty rich madder-brown tentacles (apparently of a *Medusa*) which were brought up by the sounding-line; they were studded with finely formed thread-cells.

Reference will first be made to the Annelids as they occur in the sequence of their families, and thereafter a note of the collection in its bathymetrical and geographical aspects will be appended.

The Euphrosynidæ are represented by fine examples of *Euphrosyne borealis*, Örst. While no example of the Amphinomidæ or Aphroditidæ occurs, the Polynoidæ, on the other hand, are common. The most abundant of the family, perhaps, is *Nychia cirrosa*, Pallas, the size of the specimens somewhat exceeding those from Shetland and Canada. One has its skin studded throughout with small, firm, whitish tubercles, caused by subcutaneous masses composed of a vast number of minute ovoid bodies with a firm external wall, differentiated from the slightly granular central region. No change was produced by the addition of acetic acid, but sulphuric ether shrivelled them considerably. The structures seemed to be of parasitic origin. *Nychia Amondsemi*, Mgrn., occurs likewise in fine condition. *Eunoa Oerstedii*, Mgrn., is represented by specimens an inch and three quarters long, and therefore considerably larger than those from Canada. The ubiquitous *Harmothoe imbricata*, L., is abundant, and there is nothing peculiar in size or coloration; indeed much larger examples exist in my collection from Exeter Bay, Greenland. Some varieties approached *Evarne impar*, Johnst. (a species also present); but they could always be recognized by the position of the eyes, the structure of the bristles, and other points. Many had parasitic Infusoria on the bristles. A fragment of *Eupolynoë occidentalis*, M'Int., with scales, demonstrates that the latter become in spirit of wine of a ferruginous brown hue and smooth. They have rather numerous, long, slender cilia on their outer border, and the tips of these processes are very slightly dilated. The *Lepidonotus sublevis* of Prof. Verrill* may be this or an allied form; but his description is unfortunately too lax for determination. The specimen had several parasitic Pedicellinæ.

The Sigalionidæ are represented by a fragmentary *Leanira* from 1785 fathoms (station 16), and by excellent examples of *Pholoë minuta*, Fabr.

Two species of the family Nephthydidæ occur, viz. *Nephthys cæca*, Fabr., and *N. incisa*, Mgrn., the former having many parasitic Infusoria on its bristles.

Of the Phyllodocidæ are *Phyllodoce Greenlandica*, Örsted (large specimens), *Eulalia viridis*, O. F. Müller, *Eteone pusilla*, Örst., and *Eteone flava*, Fabr., besides a fragmentary and minute *Phyllodoce*.

* Invertebrate Animals of Vineyard Sound, p. 581.

There is no example of the Hesionidæ or Syllidæ. Good specimens of *Nereis pelagica*, L., and *Nereis zonata*, Mgrn., represent the Nereidæ. The latter shows fine reddish-brown bars in the preparations. Under the family of the Lumbrinereidæ is *Lumbriconereis fragilis*, O. F. Müller, a species tolerably plentiful and of all sizes, though none are so large as those procured in the 'Porcupine' off the Spanish coast. The Eunicidæ and Onuphididæ are each represented by a single species, viz. the former by the *Eunice limosa*, Ehlers, and the latter by very large examples of *Nothria conchylega*, Sars, in tubes of small pebbles.

In the Glyceridæ are *Glycera capitata*, Örst., and *Glycera setosa*, Örst., the latter having been procured at the surface of the sea in Waigat Strait.

Four forms belonging to the Ariciidæ occur, viz. a new species allied to *Aricia Kupfferi*, Ehlers, two small fragments pertaining to different species, and *Scoloplos armiger*, O. F. Müller. In the first-mentioned species the bristles are much more developed than in *Aricia Latreillii*, while no pectinate rows of papillæ exist on the ventral surface, as in the latter, *Aricia Cuvieri*, Aud. & Ed., and *Aricia Kupfferi*, Ehlers. In this respect it agrees with *A. Norvegica*, Sars, a form which extends to the Atlantic, but differs in the structure of the process at the summit of the pectinate rows of the anterior feet. The bifid bristles in the superior division of the foot appear to be characteristic; but as previous authors seem to have overlooked them (they are present in all the species examined), the value of this test is at present not fully available. The specimen is imperfect, and measures about $\frac{3}{4}$ of an inch in length. The snout is elongated and pointed, and has traces of blackish pigment near the posterior border, dorsally. The mouth opens on the ventral surface between the posterior border of the head and the first bristle-bearing segment; and on each side it has two large curved lobes, which pass backward to the commencement of the second bristle-bearing segment. There are sixteen lateral rows bearing hooks anteriorly (2nd to the 17th), and then the form of the foot alters. These rows are for the most part furnished with pectinate papillæ, the superior being in each case longer than the others. The branchiæ commence on the fifth segment. There is no trace of pectinate rows of papillæ on the ventral surface. The forked bristles of the dorsal division of the foot have one of the limbs considerably longer than the other, and peculiarly curved.

The Opheliidæ are represented by good specimens of *Ammotrypane aulogaster*, H. Rathke, numerous examples of *Ophelia limacina*, H. R., a *Travisia*-like Annelid with no other appendage than minute bristles, and two interesting new forms. For the latter and several allied species the name *Tachytrypane* may be given, from their active boring movements through sand and mud. Though in external appearance the new forms somewhat resemble *Ammotrypane*, the structure of the body-wall and other points clearly separate them both from the latter and *Ophelia*.

The first species (*Tachytrypane Jeffreysi*) comes from station No. 9, at a depth of 1750 fathoms. The body is elongate, being upwards of two inches in spirit, and about one tenth of an inch in breadth, rounded in front, but marked by the usual ventral ridges throughout the rest of its extent. There are about thirty segments besides the head and tail, the anterior being short, those in the middle very long. The head forms a short cone, with a minute filiform process at the tip. No bristles are visible under a lens, the body being smooth and iridescent, like that of *Linotrypane apogon*, for the fine transverse lines are not conspicuous. Very minute simple bristles are, however, present: there are no cirri. The caudal process is separated by a well-marked furrow from the rest of the body, and terminates in a slender recurved process bent downward and forward.

In the structure of the body-wall *Tachytrypane Jeffreysi* forms an intermediate link between *Linotrypane** and the other forms connecting both with *Ammotrypane* and *Ophelia*. The cuticle is greatly thickened (as in *Linotrypane*), and a special process passes inward from the median line on the ventral surface towards the nerve-cord. From each side of the latter the oblique muscle slants to the body-wall, cutting off a segment of the longitudinal muscular layer; but the projection of the separated region is much less than in the Connemara specimen figured in the *Ann. & Mag. Nat. Hist.* 1875, xvi. p. 369, and therefore more closely allied to the condition in *Linotrypane*. In the latter the slender oblique muscle passes on each side from the ventral raphe upward and outward to the body-wall, and the band causes no separation of the comparatively large segment included between it and the ventral raphe. The oblique muscle is much shorter and more powerful in *Tachytrypane*, and the condition leads to that in allied forms which more nearly approach *Ammotrypane*. In the latter the change is much greater, for a single deep narrow muscle (apparently representing the coalesced oblique muscles) occurs at the ventral border, with the nerve-cord beneath; and the two segments, which in *Tachytrypane* only bulge to a slight degree, are here separated from the body by the whole breadth of the deep transverse muscle just mentioned, so that in cross-section each forms a prominent pear-shaped lobe attached by a narrow pedicle. A further differentiation is apparent in *Ophelia*; for the great transverse ventral muscle splits, and a division passes into the ventral pedicle on each side, while the nerve-cord occupies the median line superiorly.

The other species, *Tachytrypane arctica*, is minute, more slender than a young *Ammotrypane aulogaster* of the same length, and is devoid of cirri, but the bristles are prominent and curve backward. The cephalic lobe is less pointed, a pigment-speck exists on each side at the base, and the form of the caudal process is characteristic, being funnel-shaped and terminating in a smooth rim. The cuticle is dense, though less developed

* *Proc. Roy. Soc. Edinb.* vol. viii. p. 386 (1873-74).

than in the foregoing species. It was dredged at station No. 16 in 1785 fathoms. Both species had the intestinal canal filled with fine *Globigerina*-mud; so that in all probability they live in this easily penetrated medium, after the manner of their congeners in the sand.

There is a single example of the Scalibregmidæ, viz. *Scalibregma inflatum*, H. Rathke; while two forms represent the Chloræmidæ, viz. *Trophonia plumosa*, O. F. Müller, and *Flabelligera affinis*, Sars. The specimens of the latter are large.

Scolecopsis cirrata, Sars, *Prionospio Steenstrupi*, Mgrn., and a fragmentary *Spio* from station No. 3 typify the Spionidæ.

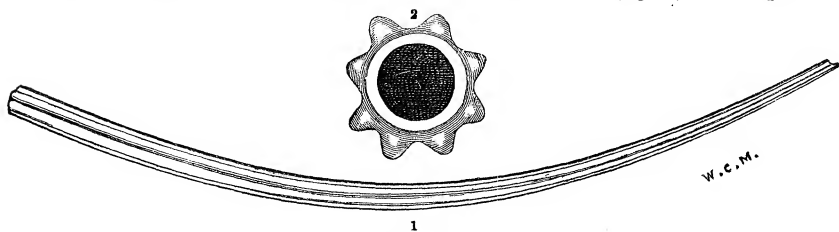
There is an example of the Cirratulidæ (*Cirratulus cirratus*, O. F. Müller), and one of the Hælmnthidæ, viz. *Capitella capitata*, Fabr.

The Maldanidæ comprise *Maldane biceps*, Sars, *Maldane Sarsi*, Mgrn. (a common Canadian form), *Nicomache lumbricalis*, Fabr., *Axiotea catenata*, Mgrn., and *Praxilla prætermissa*, Mgrn.

The family Ammocharidæ is represented by *Owenia filiformis*, D. Ch., the tubes of which closely resemble the stalks of *Alcyonidium* growing in the vicinity.

Amongst the Amphictenidæ are *Cystenides granulata*, L., and *C. hyperborea*, Mgrn., the examples in both cases being characteristically fine. The sole specimen of the Ampharetidæ is *Ampharete arctica*, Mgrn. The Terebellidæ, again, are more numerous, and comprise *Amphitrite cirrata*, O. F. Müller, *Nicolea arctica*, Mgrn., and *N. zostericola*, Örst. & Gr., *Leæna abbranchiata*, Mgrn., *Thelepus circinnatus*, Fabr. (very large), *Grymæa Bairdi*, Mgrn., and *Trichobranthus glacialis*, Mgrn., in tubes, chiefly composed of *Globigerinæ*. Certain fragments not yet determined pertain to this family.

The Sabellidæ are represented by *Sabella pavonia*, Sav., *S. vesiculosa*, Mont., *Euchone analis*, Kr., *Chone infundibuliformis*, Kr., and the Serpulidæ by a fragmentary, minute, shining quinquecostate *Serpula**, with four transverse ridges anteriorly and irregularly twisted, *Spirorbis borealis*, Daud., *S. verruca*, Fabr., *S. spirillum*, L., and the tube of an apparently new *Ditrypa*, which may be characterized as follows:—*D. Grœnlandica*. The tube is about half an inch in length, not much thicker than a thread, and curved from end to end like a bow (fig. 1). It tapers



* *Placostegus quinquecostatus*, Daud., from the Mediterranean may be an allied form.

very gradually from the anterior to the posterior end, contrasting in this respect with the more decided diminution in *D. arietina*. The oval aperture (fig. 2) forms a smooth slightly constricted rim, which is narrower than the tube almost by the depth of the ridges. The latter are eight in number, and run from the anterior to the posterior end of the tube, though, it must be added, none of the specimens were quite perfect. It was obtained from station No. 12 (1450 fathoms). It differs from any other *Ditrypa* known to me in its slender form and the well-marked longitudinal ridges.

A curious form, the affinities of which have not yet been made out, occurs at station No. 6 (410 fathoms). The head forms a blunt cone, with two short tentacles near a large eye-speck on each side. The segments are deeply cut. The dorsal division of the foot has a single large hook (somewhat resembling that figured by the late M. Claparède in Dr. Ehlers's recent paper* on the 'Porcupine' deep-sea species). The ventral bristles taper to a flattened tip with a minute claw. A series of small papillæ occur on the foot and on the conical cirrus beneath the dorsal hook.

Station.	Depth in fms.	Position.	Character of bottom.	Species.
1875. No. 1. July 22 ...	175	70° 30' N., 54 41 W. Off Hare Is- land, Disco.	Sandy mud.	Euphrosyne borealis, Eupolynoë occi- dentalis, Nephthys incisa, Nereis zo- nata, Nothria conchylega, Lumbrico- nereis fragilis, Trophonia plumosa, Scolecolepis cirrata, Maldane biceps, Nicomache lumbricalis.
No. 3. July 23 ...	100	69 31 N., 56 1 W.	Sandy mud.	Nychia Amundseni, Nephthys incisa, Nereis zonata, Nothria conchylega, Lumbriconereis fragilis, Prionospio Steenstrupi.
No. 4. July 24 ...	20	67 50 N., 55 27 W.	Shell-sand.	Harmothoë imbricata, and fragmentary Nephthys, sp. n., Phyllodoce Grœn- landica, Eteone pusilla, Nereis pelagica, Glycera capitata, three sp. of Aricia, Scoloplos armiger, Ophelia limacina, Spio, sp., Capitella capitata, Ampharete arctica, Euehione analis, Chone infun- dibiliformis, Amphiporus.
No. 5. July 26 ...	60	66 59 N., 55 27 W.	Sand & shells.	Harmothoë imbricata and var., Eteone pusilla, Eulalia, sp., Nereis pelagica, Nothria conchylega, Owenia filiformis, Leena abranchiata, Spiror- bis spirillum, Amphiporus as before.
No. 6. Aug. 10 ...	410	64 5 N., 56 47 W.	Sandy mud.	Evarne impar, Nereis pelagica, Lum- briconereis fragilis, Eunice limosa, Aricia Cuvieri, Scolecolepis cirrata, Leena abranchiata, Grymæa Bairdi, Terebellides Strömi, a remarkable form with dorsal hook, Chaetoderma.

Station.	Depth in fms.	Position.	Character of bottom.	Species.
1875. No. 7. Aug. 11 ...	1100	63° 9' N., 56 43 W.	Mud.	Lumbriconereis fragilis, Glycera capitata, Scoloplos armiger, Praxilla prætermissa, Terebellides Strömi.
No. 9. Aug. 14 ...	1750	59 10 N., 50 25 W.	Mud.	Glycera capitata, Tachytrypa Jeffreysi, Globigerina-tubes.
No. 10. Aug. 16 ...	400- 1400	58 14 N., 46 29 W.	Came up on sounding-line.	Twenty tentacles of a madder-brown Medusa.
No. 12. Aug. 19 ...	1450	56 11 N., 37 41 W.	Globigerina- ooze & stones.	Trichobranchus glacialis, Dityrypa Grœnlandica, Globigerina-tubes.
No. 16. Aug. 23 ...	1785	55 10 N., 25 58 W.	Globigerina- ooze.	Leanira, sp., Lumbriconereis fragilis, Travisia-form, Tachytrypa arctica, Prionospio Steenstrupi, Owenia filiformis, remarkable tube with fine ramose filaments.
Holsteinborg Har- bour.	7-12	.....	.....	Nychia cirrosa, Harmothoë imbricata, Pholoë minuta, Eulalia viridis, Amphiporus as before.
Ibid.	10	.....	.....	Nychia cirrosa, Harmothoë imbricata, Evarne impar, Pholoë minuta, Nephthys cæca, N. incisa, Eteone pusilla, E. flava, Cystenides granulata, Thelepus circinnatus, Euchone analis, Amphiporus as before.
Ibid.	30	.....	.....	Nychia cirrosa, Harmothoë imbricata, Scoloplos armiger, Flabelligera affinis, Cirratulus cirratus, Maldane Sarsi, Nicolea arctica, Amphiporus as before.
Ibid.	35	.....	.....	Nychia cirrosa, Eunoa Oerstedii, Euchone analis.
Godhavn Harbour, Disco.	5-20	.....	.....	Nychia cirrosa, N. Amondseni, Harmothoë imbricata, Evarne impar, Pholoë minuta, Nephthys incisa, Phyllo-doe Grœnlandica, Eteone flava, Nereis pelagica, Ammotrypane aulogaster, Flabelligera affinis, Axiothea catenata, Cystenides granulata, C. hyperborea, Amphitrite cirrata, Nicolea zostericola, Terebellides Strömi, Sabella pavonia, S. vesiculosa, Spirorbis borealis, Amphiporus as before, Priapulus caudatus.
Outside Godhavn Harbour.	80	.....	.....	Nychia Amondseni, Harmothoë imbricata, Lumbriconereis fragilis, Owenia filiformis, Cystenides granulata, Terebellides Strömi, Sabella pavonia.
At surface, Riten- benk Kulbrud, Waigat Strait.	surface.	.....	Surface.	Glycera setosa.
H.M.S. 'Alert' : No. I.	30	65 00 N., 53 00 W.	R. & G. bottom.	Harmothoë imbricata, Nereis pelagica, Thelepus circinnatus.

Dr. Malmgren's catalogue* shows that the majority of the foregoing

* Annulata Polychæta Spetsbergiæ, Grœnlandiæ, &c. (Helsingfors, 1867). The arctic specimens were collected by O. Torell and Amondsen.

species have been found in the seas of Greenland. The cursory examination of the collection made in the 'Valorous,' however, indicates that there are some not previously well known as inhabitants of these waters. Amongst the latter are *Evarne impar*, Johnst., the fragmentary *Leanira*, *Nephtys incisa*, Mgrn., *Eteone pusilla*, Örst., *Eunice limosa*, Ehlers, the new species of *Aricia*, the two new species allied to *Ammotrypane*, the *Travisia*-form, *Prionospio Steenstrupi*, Mgrn., *Maldane biceps*, Sars, *Maldane Sarsi*, Mgrn., *Praxilla pratermissa*, Mgrn., *Ampharete arctica*, Mgrn., *Nicolea zostericola*, Örst. & Gr., *Grymæa Bairdi*, Mgrn., *Sabella pavonia*, Sars, *S. vesiculosa*, Mont., and those formerly mentioned.

The Annelids from the Gulf of St. Lawrence are not yet fully worked out; but so far as observed the following comparison may be made (it will also be seen that the majority are Norwegian forms):—

I. Annelids common to the Gulf of St. Lawrence and the 'Valorous' Collec- tion. The * indicates a Norwe- gian form.	II. St. Lawrence forms not present in 'Valorous' Collection. *Norwegian.	III. Norwegian forms in 'Valo- rous' not indicated in Column I.
*Nychia cirrosa. — Amdonseni. *Eumoa Oerstedt. *Eupolynoë occidentalis. *Pholoë minuta. *Nephtys incisa. *Phyllodoce Groenlandica. *Nereis pelagica. *Nothria conchylega. *Lumbriconereis fragilis. *Glycera capitata. *Scoloplos armiger. *Ammotrypane aulogaster. *Ophelia limacina. *Scalibregma inflatum. *Trophonia plumosa. *Scolecolepis cirrata. *Prionospio Steenstrupi. *Capitella capitata. *Maldane Sarsi. *Nicomache lumbricalis. *Axiothea catenata. *Owenia filiformis. *Cystenides hyperborea. *Thelepus circinnatus. *Terebellides Strömi. *Sabella pavonia. *Chone infundibuliformis.	*Aphrodita aculeata. *Lætmonice flicornis. *Lepidonotus squamatus. *Lagiscea rarispina, var. Malmgrenia Whiteavesii. *Antinoë Sarsi. Nemidia canadensis. — Lawrencii. Polynoë Gaspéensis. *Sthenelais limicola. *Leanira tatragona. *— hystricis. *Onuphis sicula. *Goniada maculata. Ephesia gracilis. *Eumenia crassa. *Praxilla gracilis. *Artacama proboscidea. *Sabella saxicava ?	Euphrosyne borealis. Harmothoë imbricata. Evarne impar. Nephtys caeca. Enlalia viridis. Eteone pusilla. Nereis zonata. Glycera setosa ? Flabelligera affinis. Cirratulus cirratus. Ampharete arctica. Amphitrite cirrata. Nicolea arctica. — zostericola. Legna abbranchiata. Grymæa Bairdi. Trichobranchus glacialis. Euchone analis. Spirorbis borealis. — spirillum.
*26 2 not Norwegian.	Balanoglossus. Sternaspis. 20	20 28 48 'Valorous.' 46 Norwegian. 9 St. Lawrence, not Nor- wegian. 20 'Valorous' and Nor- wegian, not St. Law- rence. 7 St. Lawrence, not Nor- wegian or 'Valorous.'
28 Priapul. Chaetoderma.		

HYDROZOA.

By Professor ALLMAN, F.R.S., P.L.S.

Among the Hydroids of the 'Valorous' dredgings which I have as yet examined are many new species, and some which I believe I must place in new generic groups. The curious organism dredged in 1450 fathoms, lat. $56^{\circ} 11' N.$, long. $37^{\circ} 41' W.$, is especially interesting; for though it retains none of its soft parts, I have little doubt of its being a second species of *Stephanoscyphus*, found hitherto only in the Mediterranean, unless some dried specimens from the North Atlantic, which I had formerly received from Mr. Gwyn Jeffreys, should be referable to the same genus, a fact by no means improbable.

There is also a little Campanularian in which I can find no point which will specifically distinguish it from a species obtained at Kerguelen Island by Mr. Eaton, the naturalist of the 'Transit' Expedition to that island. I have not yet completed my examination of all the specimens. The work is necessarily slow where every specimen is to be submitted to microscopic examination, and careful drawing made of such as may turn out to be new.

CORALS.

By Professor DUNCAN, F.R.S., P.G.S.

The Corals sent to me were dredged in 690 fathoms, lat. $56^{\circ} 1' N.$, long. $34^{\circ} 42' W.$ They consist of:—

1. A small *Caryophyllia*; a young individual. The species can hardly be determined, but I believe that it is not a new form.

2. *Flabellum laciniatum*; fragments, showing an unusual scantiness of carbonate of lime.

FORAMINIFERA.

By WILLIAM B. CARPENTER, M.D., LL.D., F.R.S.

The *calcareous-shelled* Foraminifera collected during this cruise did not present any novelty either as regards type or distribution, except that the beautiful deep-sea form of *Orbitolites* which I noticed in the first 'Porcupine' Report (1869, § 36), and which I subsequently met with in the Mediterranean, occurred abundantly in the Baffin's-Bay and North-Atlantic dredgings—attaining the same large size in the far north as it does off the west coast of Ireland and in the Mediterranean, and showing here, as elsewhere, a true spiroloculine centre, which indicates the close relation of its *cyclical* to the *spiral* plan of growth. The *Nodosarine* type is peculiarly conspicuous in the size of individual specimens, especially smooth-shelled *Nodosarians*, as also in the number and beauty of its more delicate and beautifully sculptured forms.

But the *arenaceous* Foraminifera furnish a most interesting addition to those collected in the 'Porcupine' Expeditions, and show, by their extraordinary size and relative abundance, that this type is preeminently

adapted to live on the bottom of deep seas—the most productive haul having been the dredging in 1750 fathoms (No. 9, Davis Strait). This furnished, among other well-known types, abundance of the small nautiloid *Lituola canariensis*, and peculiarly large and regular specimens of the “spirilline” *Trochammina irregularis*, the surface of which is finished off with a smooth “plaster” composed of the finest sand-grains worked up with abundance of ferruginous cement.—I shall now briefly notice the more important novelties obtained in the ‘Valorous’ dredgings.

Retaining, for the present, the general term *Lituola* for “tests” composed of sand-grains firmly cemented together by phosphate of iron, and imitating more or less closely the forms of calcareous-shelled genera, I may specially notice the following as among its most conspicuous types:—

a. A large “nodosarine” *Lituola*, composed of a series of globular segments arranged in linear succession—the axis of growth being sometimes nearly straight, sometimes regularly curved, sometimes irregular, and the segments having no other connexion with each other than that which is afforded by the small tubular neck which projects from each to be received into the next. The wall of each segment, which is of very uniform thickness, is composed of extremely fine sand-grains, laid together so as to constitute a beautifully smoothed surface both interiorly and exteriorly; and the tubular neck has a perfectly circular orifice, surrounded by a ring of somewhat deeper colour, which indicates that the ferruginous cement is here present in greater quantity. The number and size of the chambers varies in different specimens. The largest I have met with, which is about 0·45 inch in length, has only four chambers—the first having a diameter of about 0·08 inch, the second of 0·10 inch, the third of 0·12 inch, and the fourth of 0·15 inch. Another, whose total length would be about the same if the chambers were arranged in regular linear series, has nine chambers—the diameter of the last or largest chamber being somewhat less than that of the first or smallest in the preceding, whilst that of the first is only about 0·02 inch.

b. Another “nodosarine,” composed of segments of an ovoid shape, the small end of each being prolonged into a tubular neck with a circular orifice which is received into the next segment, and the prolonged neck of the last segment forming the mouth. The total length of this usually ranges between 0·4 and 0·7 inch, and the number of segments is commonly from seven to ten; its general form closely resembling that of the calcareous-shelled *Dentalina guttifera*, D’Orb., of which unusually large specimens, attaining a length of 0·45 inch, occur in the same 1750 fathoms dredging. But a series of small and very delicate forms, exactly similar in type, also presents itself in this dredging, their total length ranging downwards from 0·25 to 0·15 inch. And in another series, distinguished by the excess of the breadth over the length of the segments, most perfect forms, composed of excessively minute sand-grains, present as many as

twelve segments in a total length of about 0·12 inch. On the other hand, in the 1450 fathoms dredging (No. 12) are fragments which appear to belong to the same type, except that the small end of each segment is elongated into a tubular neck which intervenes between each segment and its successor, so that the whole test would present the aspect of a tube with egg-shaped enlargements at intervals. The length of a single flask-shaped segment with its neck is sometimes as much as 0·16 inch.

c. Another series, which I may distinguish as the "orthocerine," consists of arenaceous tubes, sometimes attaining a length of 0·8 or even 0·9 inch, having an average diameter of about 0·1 inch; they usually vary but little in diameter from one end to the other, but are slightly constricted at somewhat irregular intervals, so as to show an imperfect division into about ten or twelve segments. When perfect, these tubes are usually closed and rounded at one end, which encloses a globose or ovoid chamber, commonly marked off from the rest either by an external constriction or by an internal thickening of the wall. At the other extremity the tube, which is there often somewhat conical, has a circular mouth; but the finish of this mouth, as of the entire tube, is not nearly so perfect as in the types already described. The incomplete segmentation of each tube pretty obviously marks successive additions to its length; and these additions are far less uniform in length than they are in transverse diameter; so that while the latter is pretty constant throughout, the length of a segment may be much less than its breadth, or may be as much as twice as great.—The special interest of this orthocerine test, therefore, consists in its combination of inconstancy of detail with great constancy of general form and proportion, and in the transitional stage it presents between the monothalamous and the polythalamous types. For the whole cavity may in one sense be said to consist of but a single chamber; whilst in another it may be said to be composed of a series of freely communicating chambers. And the component sand-grains are much less firmly cemented together than they are in the preceding types—some specimens approaching, in the looseness of their aggregation, the *Astrorhizæ* and the large polythalamous orthocerine *Lituolæ* of the 'Lightning' collection*, as also the monothalamous *Lituolæ* collected in the 'Porcupine'†, whose claim to relationship to the preceding mainly consists in the possession of a slightly projecting circular mouth, along the border of which the sand-grains are united by the ferruginous cement which is almost entirely wanting in the "test" generally.

The sarcodic contents of these *Lituolæ* have the dark olive-green hue which I have previously noticed as prevalent among the large arenaceous deep-sea Foraminifera. But it is a curious circumstance that many of the "orthocerine" tubes were found to be occupied by a large parasitic

* Proceedings of the Royal Society, vol. xvii. p. 172, § 13.

† *Op. cit.* vol. xviii. p. 443. § 76.

Protozoon of the *Gregarina* type. The most careful examination has failed to detect in this any higher organization than that of ordinary *Gregarina*; and its parasitic character may be inferred from the fact that I often found it coexisting in the same tube with the ordinary sarcodic body of the *Lituolæ*, which was then more or less reduced in bulk, indicating that the latter had been partially preyed on by the former. Moreover, I found a precisely similar body coiled up in the midst of a mass of sand that occupied the interior of a large detached and partly broken spherical segment of a "nodosarine."

d. Another series of "orthocerine" *Lituolæ* is of great interest as conducting us towards what seems at first sight an entirely distinct type, the *Rhabdammina* of Sars. These are straight tubular cylindrical rods, nearly uniform in diameter, and distinguished from the preceding by their extreme slenderness. Some of them are nearly an inch in length, while their diameter never exceeds 0.03 inch, being often not half that amount. The larger of these specimens presented themselves in great abundance in the 410 fathoms dredging (No. 6, Davis Strait); the smaller and less numerous examples in the 1750 fathoms dredging (No. 9). Sometimes they are nearly uniform in size from end to end; in other cases there are constrictions at irregular intervals, forming an imperfect segmentation; while sometimes the tube narrows for part of its length, and then enlarges again. The sand-grains, usually rather coarse, of which these tubes are composed are very firmly united by ferruginous cement; and the non-segmented rods bear so exact a resemblance to those which form the extensions of the triradiate *Rhabdammina* (Sars), that they might easily be supposed to be detached arms of that very curious form*. In fact, when we met with similar rods in dredgings containing also large numbers of *Rhabdammineæ*, this was the light in which my colleague was accustomed to regard them. A careful examination of the varietal forms of *Rhabdammina*, however, had led me to the conclusion that the typical triradiate form might graduate into a single long rod; for when, as often happens, one of the three rays is imperfectly developed, the others are not only longer than usual, but diverge at an angle greater than 120° , this divergence increasing in proportion to the suppression of a third ray, until it reaches 170° , so that the two rays come so nearly into the same straight line, that a single very long straight rod may be considered as the representative of two of the three rays of the typical triradiate *Rhabdammina*. And I used to enforce this view by a comparison of the large number of single straight rods which often came up in one dredging, with the small number of triradiate *centra* from which they could be supposed to be detached—the former being often *six* or *eight* times as numerous as the other, whilst they ought not to have exceeded *three* times. Now in the two 'Valorous' dredgings which furnished these straight rods in the greatest abundance

* Proceedings of the Royal Society, xvii. p. 172.

only two or three triradiate *Rhabdammina* centra presented themselves; so that I feel justified in concluding that the long straight rods are not rays of *Rhabdammina* broken off from their centra, but that each represents two elongated and straightened-out arms of a *Rhabdammina* whose third arm is abortive. The gradation towards the orthocerine *Lituolæ*, marked by their occasional imperfect segmentation, is only another case of that general doctrine of intimate mutual relationship which I have on several occasions pointed out as existing in each of the two groups of *perforate* and *imperforate* Calcareous-shelled Foraminifera, and which, when all the new deep-sea *Arenaceous* types shall have been carefully worked out, will be found, I feel confident, to be completely applicable to that third series which is now coming to rival the other two in the variety of its forms.

What is the relation between the Arenaceous and the Calcareous-shelled *Foraminifera* (whether the former are the elder, and the latter the derived forms), is a question on which I shall at present only suggest, reserving what I have to say upon it to some future opportunity.

DIATOMS.

By Professor GEORGE DICKIE, F.L.S.

Mr. Gwyn Jeffreys, during the voyage of the 'Valorous,' collected by means of the towing-net, in lat. $58^{\circ} 55' N.$, long. $34^{\circ} 18' W.$, a peculiar organism having the appearance of a small sponge. It was found to have a very wide range, extending over some thousands of square miles.

The general aspect of a specimen preserved in spirit is such that it might be readily mistaken for a sponge.

Specimens were submitted to Dr. Bowerbank and Mr. Carter. They both reported it not to have the character of a sponge. The latter was more specific in his opinion, and pronounced it be a Diatom, probably a *Synedra*. Before receiving Mr. Carter's report I had arrived at the same conclusion.

The organism is a new species of the genus *Synedra*, and remarkable on account of the large proportion of colloid matter which seems to connect the frustules in masses. The former may be compared to the sarcode, the latter to the spicules of a sponge; but there is mere resemblance only. It is further notable on account of the great length of the frustules as contrasted with their breadth.

The countless multitudes of this Diatom and of others of the same family, and the extent of sea over which they extend, are points of much interest, contributing directly as they do to the support of various smaller marine animals, and these in turn to larger forms, adding also to deposits taking place at various depths. I add a brief description of *Synedra Jeffreysi*:—Frustules greatly elongated, straight, in front view linear, ends subcapitate, no pseudo-nodule, in side view linear rectangular,

striae marginal. The total length varies from a ninth to a tenth of an inch, and the front view has a diameter about $\frac{1}{4000}$, the side view about $\frac{1}{2500}$ of an inch. The striae are 40 to 50 in a thousandth of an inch.

From Mr. Jeffreys I also received specimens of an organism found by Mr. Hart, the naturalist of the 'Discovery,' drifting on the surface in lat. $59^{\circ} 36' N.$, long. $39^{\circ} 10' W.$ The same was also found by Mr. Jeffreys in $59^{\circ} 16' N.$, long. $37^{\circ} 16' W.$ It consists of dense fleece-like tufts of a species of *Podosphenia*. It agrees very well with the characters of *P. elongata*, Ktz. The latter species is not uncommon on European coasts growing upon various Algæ. The specimens collected by Mr. Hart are attached to fragments of Algæ, in one case, apparently, to a piece of a species of *Fucus*, and therefore probably drifted from some coast-line. I have compared Mr. Hart's specimens with a Scotch example of *P. elongata*, and I find they agree. The frustules in the latter vary in length and breadth; specimens from the North Atlantic have, for the most part, shorter and broader frustules.

Lat. $59^{\circ} 10' N.$, long. $50^{\circ} 25' W.$, 1750 fathoms.

One Diatom only, viz. *Coscinodiscus radiatus*, Ehrb.

Also various Polycystina, Foraminifera, and spicules of Sponges.

Surface-drift. Lat. $59^{\circ} 36' N.$, long. $39^{\circ} 10' W.$

A tufted Diatom, viz. *Podosphenia elongata*, Ktz.

Station No. 13. Lat. $55^{\circ} 58' N.$, long. $31^{\circ} 41' W.$, 1230 fathoms. Fine adhesive mud, bluish when moist, dirty white when dry.

Diatomaceæ: *Coscinodiscus radiatus*, Ehrb.; *C. lineatus*, Ehrb.; *C. minor*, Ehrb.; *Amphora granulata*, Greg.; *Synedra Jeffreysi*, n. sp.

Along with these, two Polycystina (*Dictyocha fibula*, Ehrb., *D. gracilis*, Ehrb.), with fragments of a *Rotalia* and sponge-spicules.

Twenty grains of this mud, partly soluble with effervescence in acid, left a residue which, when washed and dried, weighed 14 grains.

Lat. $55^{\circ} 38' N.$, long. $28^{\circ} 42' W.$, 1485 fathoms. A fine dirty-white mud.

Diatomaceæ: *Coscinodiscus radiatus*, Ehrb.; *C. minor*, Ehrb.

Also fine siliceous particles, fragments of sponge-spicules, and numerous Coccoliths.

Twenty grains, partly soluble with effervescence in acid, left a residue which, after being washed and dried, weighed 12 grains.

Lat. $62^{\circ} 6' N.$, long. $55^{\circ} 56' W.$, 1350 fathoms. A grey mud, very adhesive.

Diatomaceæ: *Coscinodiscus radiatus*, Ehrb.; *C. minor*, Ehrb. Foraminifera: *Rotalia globosa*.

Also fragments of sponge-spicules and numerous Coccoliths.

Twenty grains, partly soluble with effervescence in acid, when washed and dried, left a residue weighing 15 grains.

Holsteinborg Harbour : 10 fathoms. Chiefly a blackish sand.

The washings yielded the following Diatoms :—*Coscinodiscus oculus iridis*, Ehrb.; *Amphora proteus*, Greg.; *A. Leighsmithiana*, O'Meara; *A. lanceolata*, Cleve; *Navicula didyma*, Ehrb.; *N. ovalis*, Sm.; *Nitzschia distans*, Greg.; *Grammatophora marina*, Ktz.

From H.M.S. 'ALERT.'

Station No. 1. Lat. 65° N., long. 53° W., 30 fathoms.

Diatomaceæ :—*Grammatophora marina*, Ktz.; *Rhabdonema arcuatum*, Ktz.; *Navicula Archeriana*, O'Meara; *N. elliptica*, Sm.; *N. pinnularia*, Cleve; *Coscinodiscus subtilis*, Ehb.; *C. radiatus*, Ehb.; *C. oculus iridis*, Ehb.; *Cocconeis glacialis*, Cleve; *Amphora cymbifera*, Greg.

CATALOGUE OF PEBBLES AND MINERALS DREDGED BY
MR. GWYN JEFFREYS.

28 Jermyn Street, Nov. 8, 1875.

1. 690 fathoms. Amygdaloidal porous decomposing igneous rock, light and spongy, owing to decomposition. *Probably from Iceland.*
2. 690 fathoms. Station 12. Admiralty, No. 9. Lat. 56° 1' N., long. 34° 42' W. Aug. 20, 1875. Felstone and quartzite, altered basalt.
3. 410 fathoms. Small pebbles of gneiss and quartzite from No. 5. Aug. 10, 1875.
4. 1450 fathoms. Fine-grained quartzite (many nodules); gneiss; argillaceous limestone (Silurian?); fine-grained sandstone; hornblendic rock, much quartz; fine-grained felstone; pale buff sandstone; hornblende and quartz; amygdaloidal greenstone (vesicular); fine-grained siliceous rock; steel-grey felspathic rock, fine-grained; felstone, grey, close-grained. Rock specimens all rounded and water-worn. *Most likely derived from Iceland.*
5. Minerals same depth, marked 1450 fathoms, No. 11. Aug. 19, 1875. Black mica; obsidian; quartz (crystallized); flint; basaltic rock in same series.
6. 1750 fathoms. Lat. 59° 10' N., long. 50° 25' W. Quartz pebbles; ashy matter, igneous; vesicular rock (decomposed amygdaloidal trap?). *Probably Iceland.*
7. 1785 fathoms. Lat. 55° 10' N., long. 25° 58' W. Decomposing argillaceous limestone.

All the pebbles associated with the *Balani* from the shore are gneiss; much white quartz in the matrix.

R. ETHERIDGE.

SOUNDINGS AND DREDGINGS OBTAINED ON PASSAGE FROM
DISCO TO ENGLAND.*In Davis Strait.*

No. of Station.	Lat.	Long.	Depth in fms.	Nature of bottom.	Bottom-temp.	Remarks.
	N.	W.				
1.	70° 30'	54° 41'	175	Sand, mud.	.....	Dredging.
2.	70 27	55 0	85	Gravel, stones.	.....	Ditto.
3.	69 31	56 1	100	Mud.	.....	Ditto.
4.	67 56	55 27	20	Broken barnacles and shells.	.....	Ditto.
5.	66 55	55 30	57	Rock, sand, shells.	.....	Ditto.
6.	64 5	56 47	410	Sand, mud.	34·6	Serial temperature, dredging.
7.	63 9	56 43	1100	Clay, mud.	36·4	Ditto ditto.
8.	62 6	55 56	1350	Mud (blue clay under).	34·6	
9.	59 10	50 25	1750	Ditto.	34·0	Dredging.
<i>In North Atlantic.</i>						
10.	58 14	46 29	1660	Fine sand.	34·3	Serial temperature.
11.	57 50	44 52	1860	Globigerina ooze.	33·4	
12.	56 11	37 41	1450	Glob.-ooze, stone.	36·3	Serial temperature, dredging.
13.	56 1	34 42	690	Glob.-ooze.	38·2	Dredging.
14.	55 58	31 41	1230	Mud.	36·8	
15.	55 58	28 42	1485	Clay, blue mud.	36·5	Serial temperature.
16.	55 10	25 58	1785	Glob.-ooze (blue mud under).	36·7	Dredging.

N.B. In the accompanying Chart (Plate 2) the outward course of the voyage is shown by a plain line, and the homeward or return course by a dotted line.

XXV. "Report on the Physical Investigations carried on by P. HERBERT CARPENTER, B.A., in H.M.S. 'Valorous' during her Return Voyage from Disco Island in August 1875." By WILLIAM B. CARPENTER, C.B., M.D., F.R.S. Received June 15, 1876.

INTRODUCTION.

The despatch of H.M.S. 'Valorous' to Disco Island, in the summer of 1875, with stores for the use of the Arctic Discovery Ships, having afforded an opportunity for the prosecution of a Deep-Sea Physical and Biological Exploration of the North Atlantic and Baffin's Bay, which should be complementary to the work elsewhere carried on by the 'Challenger,' a suggestion for the prosecution of this inquiry on the return voyage of the 'Valorous' was made by the Council of the Royal



Exocoela formosa, Zellr.

